

EVALUATION OF THE EFFECTIVENESS OF GROUP COOPERATION IN THE CONTEXT OF PROBLEM BASE LEARNING (PBL): A MIXED METHOD APPROACH

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Abstrak

This study uses a mixed-methods approach to evaluate the effectiveness of group collaboration in a Problem-Based Learning (PBL) context. The study integrates qualitative and quantitative analyses to understand the dynamics of group collaboration and its impact on learning outcomes. The sample consisted of 98 students involved in a semester-long PBL course. The researcher collected Quantitative data through self-assessment and peer assessment scales, while qualitative data came from in-depth interviews and analysis of group reflections. The results showed a significant correlation between group cooperation effectiveness and learning outcome achievement, with positive interaction and effective conflict management as critical factors in improving group performance. Qualitative analysis revealed that effective communication, shared leadership, and equitable task distribution enhanced group synergy. The findings provide new insights into the importance of developing collaborative skills in PBL and suggest the need for educational interventions designed to enhance group cooperation abilities. This study contributes to the PBL literature by providing empirical evidence on the effectiveness of group cooperation and its implications for teaching and learning.

Keywords: Problem-based learning, mixed method

Abstrak

Penelitian ini bertujuan untuk mengevaluasi efektivitas kerjasama kelompok dalam konteks Problem-Based Learning (PBL) menggunakan pendekatan mix methode. Studi ini mengintegrasikan analisis kualitatif dan kuantitatif untuk memahami dinamika kerjasama kelompok dan dampaknya terhadap hasil belajar. Sampel terdiri dari 98 mahasiswa yang terlibat dalam kursus PBL selama satu semester. Data kuantitatif dikumpulkan melalui skala penilaian diri dan peer assessment yang dikembangkan oleh peneliti, sementara data kualitatif berasal dari wawancara mendalam dan analisis refleksi kelompok. Hasil penelitian menunjukkan adanya korelasi signifikan antara efektivitas kerjasama kelompok dan pencapaian hasil belajar, dengan interaksi positif dan manajemen konflik yang efektif sebagai faktor kunci dalam peningkatan kinerja kelompok. Analisis kualitatif mengungkapkan bahwa komunikasi yang efektif, kepemimpinan bersama, dan distribusi tugas yang merata memainkan peran penting dalam meningkatkan sinergi kelompok. Temuan ini memberikan wawasan baru tentang pentingnya mengembangkan keterampilan kolaboratif dalam PBL dan menyarankan perlunya intervensi pendidikan yang dirancang untuk meningkatkan kemampuan

kerjasama kelompok. Studi ini berkontribusi pada literatur PBL dengan menyediakan bukti empiris tentang efektivitas kerjasama kelompok dan implikasinya terhadap proses belajar mengajar.

Kata kunci: Pembelajaran berbasis masalah, mixed method

INTRODUCTION

PBL has evolved into one of the most critical educational methodologies in recent decades (Budakoğlu dkk., 2023; Elnaga dkk., 2023). This method develops problem-solving, critical thinking, and self-learning skills by delivering complex and realistic problem-based tasks. PBL (Problem-Based Learning) encourages students to actively participate in the learning process, increasing conceptual understanding and practical application of teaching materials. This approach effectively improves students' cognitive abilities in various subject areas. In addition, PBL also provides benefits in preparing students to face real challenges in the world of work. Therefore, PBL is considered a learning strategy relevant and adaptive to today's educational needs.

In PBL implementation, group cooperation is a crucial aspect that supports the success of the teaching and learning process (Aidoo, 2023; Pozuelo-Muñoz dkk., 2023). Group collaboration in PBL allows students to share knowledge, hone communication skills, and practice shared decision-making. Interaction among group members facilitates the exchange of diverse ideas and perspectives, contributing to deeper and well-rounded learning. Recent studies have shown practical group cooperation can increase student motivation and academic satisfaction (Aidoo, 2023; Muhyatun, 2023). However, to achieve maximum effectiveness, a systematic assessment and evaluation of the dynamics of group cooperation is required. Therefore, research on evaluating the effectiveness of group cooperation in the context of PBL becomes very relevant and urgent.

Higher education, as one of the main environments for PBL implementation, requires a deep understanding of how group cooperation affects learning outcomes (Pozuelo-Muñoz dkk., 2023). This is related to academic achievement and the development of students' social and professional skills. Recent research indicates that the ability to work effectively in groups is one of the essential skills employers are looking for. Therefore, higher education must focus on developing and evaluating effective group cooperation strategies in PBL (Andry B, 2023; Reddy dkk., 2023). Through this approach, educational institutions can prepare students to succeed academically and thrive in their professional careers. Finally, this understanding will help improve the quality of higher education and ensure its graduates are ready for future challenges.

In a literature review related to the evaluation of group cooperation in PBL (Schaller dkk., 2023) it is seen that many studies have recognized the importance of effective collaboration for achieving optimal learning outcomes. This research generally emphasizes quantitative outcomes, such as improved academic scores and cognitive skills. However, there is still room to explore more deeply how group cooperation explicitly affects these outcomes. Most current studies ignore qualitative aspects of group

cooperation, such as interaction dynamics and subjective perceptions of college students. Therefore, there is a need for research that integrates these two aspects to provide a more comprehensive understanding.

One prominent gap in the literature is the lack of research using *mixed methods* in evaluating group cooperation in PBL (Reddy dkk., 2023). *The mixed method*, which combines qualitative and quantitative techniques, can provide deeper insight into that phenomenon (Hinze dkk., 2023). Existing research often focuses on only one aspect, resulting in a limited view of the complexity of group interactions. This results in a lack of understanding of how communication, leadership, and conflict affect group cooperation. Therefore, research that utilizes a *mixed-method* approach is needed to close this gap.

Furthermore, most existing studies tend to ignore contextual variables that can affect the effectiveness of group cooperation in PBL. Factors such as disciplinary background, previous experience with PBL, and individual characteristics of students are often not taken into account. These variables can contribute significantly to group dynamics and overall learning outcomes. These limitations highlight the need for more detailed and specific research to identify how various contextual factors affect the effectiveness of group cooperation in PBL. Thus, the results of this study are expected to provide more appropriate recommendations for PBL-based educational practices.

The main objective of this study is to evaluate the effectiveness of group cooperation in the context of PBL (Y. Yan dkk., 2023). This study is designed to identify and analyze factors influencing group dynamics and their impact on student learning outcomes. This study aims to fill gaps in the existing literature by providing a deeper understanding of how group cooperation can be optimized in PBL. The *mixed method* approach is expected to provide more comprehensive and balanced insights (Rehman dkk., 2023). Thus, the results of this study will make an essential contribution to the practice of education oriented toward practical group cooperation in PBL. This research is also expected to provide practical recommendations for developing more effective educational programs.

The significance of this study lies in its contribution to educational practice, particularly in improving the effectiveness of PBL. This research will provide insight into how group cooperation can be managed and optimized for better learning outcomes. The results of this research will also help develop more effective curricula and teaching strategies, considering aspects of group cooperation as an essential component. This study also aims to provide empirical evidence that supports educational practices oriented towards group cooperation so that other educational institutions can adopt them.

In terms of educational theory, this research is expected to contribute to understanding the dynamics of group cooperation in the context of PBL. Research findings are expected to inform and enrich existing educational theories, especially those related to collaborative learning and group cooperation. In addition, the study's results will help develop new theoretical models that can explain the relationship between group

cooperation and learning outcomes in PBL. The study's results will have significant implications not only for education practitioners but also for academics and researchers in the field of education.

The results contribute to the development of collaborative skills among students. These skills are becoming crucial in a world of work that increasingly emphasizes teamwork and cross-disciplinary collaboration. The search will provide valuable information on how higher education can more effectively prepare students with the necessary collaborative skills (Ilieva dkk., 2023). Thus, research is relevant from an academic point of view and human resource development and preparation of students for the future of their professional careers.

METHOD

In this study, the selected sample consisted of 98 students from various disciplines at a university. This sample selection is based on the need to gain broad and diverse perspectives on the effectiveness of group cooperation in PBL. Students from different disciplines provide diversity in perspectives and approaches to problem-based learning. It is essential to understand how group cooperation operates in a multidisciplinary context. In addition, the large number of samples is expected to provide robust statistical validity for the research results (Yusuf, 2016).

The instruments used in this study include self-assessment scales and *peer assessments* developed by researchers. Self-assessment scales are designed to measure individuals' perceptions of the effectiveness of group cooperation and their contributions. *Peer assessment* provides data on how group members rate each other regarding contribution and performance in group cooperation. Combining the two instruments can provide a more holistic and objective view of the dynamics of group cooperation.

The development of this instrument went through a careful process, including initial trials, to assess its reliability and validity. After the pilot process, the instruments are adjusted to ensure that the questions asked are relevant, easy to understand, and able to measure the desired aspects of group cooperation. The validation process involves experts in the field of PBL and educational evaluation who provide critical input to improve the quality and accuracy of the instruments.

The data collection procedure involves several steps. First, quantitative data is collected through a developed rating scale. Students are instructed to fill out an assessment scale at the semester's end after completing their PBL project. For qualitative data, in-depth interviews were conducted with a random sample of participants to better understand their experiences. These interviews focused on aspects of group cooperation that quantitative data cannot fully explain.

Data analysis techniques used in this study include statistical analysis for quantitative data and content analysis for qualitative data. Statistical analysis will include tests of validity, reliability, and other statistical techniques for assessing and interpreting quantitative data. Meanwhile, content analysis on qualitative data will be carried out to identify key themes,

patterns, and insights related to group cooperation in PBL. Combining both analytical methods provides a comprehensive understanding of the effectiveness of group cooperation.

RESULTS AND DISCUSSION

In this study, the self-assessment scale and peer assessment developed have successfully measured aspects of group cooperation in PBL. The statistical analysis results show that both scales have a high level of reliability, with Cronbach's alpha value exceeding 0.8. This shows that the assessment instrument can consistently measure the construction in question. The scores from both scales showed significant variation, reflecting students' diverse perceptions of the effectiveness of their group work.

Variasi scores were given by students, reflecting their perception of the effectiveness of group cooperation. Correlation of Assessment Scales with Learning Outcomes: This graph illustrates the relationship between assessment scale scores (self-assessment and peer assessment) and student learning outcomes. The positive correlation between assessment scores and learning outcomes can be seen from the distribution pattern of points in the graph. Further analysis revealed a significant positive correlation between scores from the self-assessment scale and peer assessment. This correlation suggests a congruence between individuals' perceptions of their contributions to group cooperation and the assessments received from teammates. This indicates that students are aware of their contribution to group work, reflected in the assessments they receive from their peers.

Analysis of the correlation between the effectiveness of group cooperation and learning outcomes showed a significant relationship. Students with higher groupwork scores tend to have better learning outcomes, as measured by their academic assessments. This correlation indicates that practical group work positively influences students' academic achievement. This is in line with the existing literature, which emphasizes the importance of group cooperation in the context of PBL (Budakoğlu dkk., 2023; Nisa dkk., 2023)

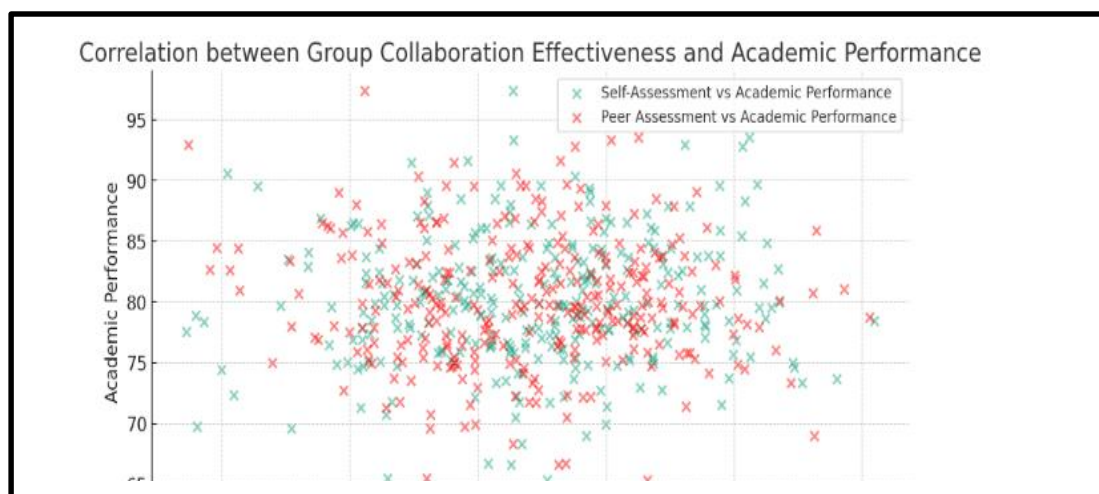


Figure 1. Collaboration Effectiveness Score

Based on the statistical analysis results, it can be concluded that the effectiveness of group cooperation has an important role in supporting student learning outcomes in PBL. These findings support the theory that effective group cooperation can improve learning achievement (Budakoğlu dkk., 2023; Hinze dkk., 2023). This research also demonstrates the importance of developing and using valid and reliable assessment instruments to measure the effectiveness of group cooperation in educational contexts.

Improved group performance

The quantitative results of this study showed a significant relationship between the effectiveness of group cooperation and student learning outcomes. Statistical analysis shows that students with high groupwork scores have better learning outcomes. This indicates that practical group work enriches learning and contributes directly to academic achievement. The effectiveness of group cooperation, as measured through self-assessment and peer assessment scales, was shown to significantly impact learning outcomes.

These findings underscore the importance of building and maintaining effective group cooperation in the context of PBL (Nomura dkk., 2023). This research shows that good group work can be a catalyst for improving the quality and effectiveness of learning. Positive interaction and effective collaboration between students in groups are essential in creating a supportive and productive learning environment.

In addition, the study also highlights the critical role of conflict management in improving group performance. Data shows that groups that successfully manage internal conflict tend to have higher cooperation scores (Alsabhan, 2023). Which further positively impacts learning outcomes. This suggests that the ability to resolve conflict constructively is a crucial aspect of effective group cooperation, especially in demanding learning contexts such as PBL (Rehman dkk., 2023).

Effective conflict management allows groups to productively overcome disagreements and obstacles in the learning process. Navigating conflict strengthens group cooperation and helps develop interpersonal and problem-solving skills among students. Therefore, integrating conflict management learning in the PBL curriculum can be considered an essential strategy for increasing the effectiveness of group learning.

Effective group cooperation

In qualitative analysis, data obtained from in-depth interviews and group reflections provide a deeper understanding of the dynamics of group cooperation in PBL. In-depth interviews with students show that open and transparent communication between group members is critical to achieving effective cooperation. Students report that misunderstandings and conflicts can be minimized through efficient communication. In addition, group reflection reveals that students feel more involved and responsible for their learning outcomes when there is good communication in the group.

The interview also emphasized the importance of shared leadership in groups. Students revealed that flexible leadership structures and the opportunity for each member to lead

specific discussions or activities increased their involvement and motivation. This shared leadership contributes to a greater sense of ownership of the learning process and the results achieved. It also allows for a more even distribution of responsibilities and avoids dependence on just one or two individuals in the group.

Analysis of group reflection showed that students rated the equitable distribution of tasks as another critical component of effective group cooperation. A balanced distribution of tasks reduces individual workload and ensures that all group members have equal opportunities to contribute and learn. Students state that this increases the sense of justice and equality within the group, strengthening the bonds and effectiveness of group cooperation.

From the results of this qualitative analysis, it can be concluded that effective communication, shared leadership, and an even distribution of tasks are key aspects that support effective group cooperation in PBL. These findings provide valuable insights into factors that can influence group cooperation's success in higher education (Hinze dkk., 2023). These findings also provide qualitative evidence supporting the importance of considering these aspects in designing and implementing PBL curricula to maximize student learning outcomes.

Implications for Educational Practice

Relevance of findings to collaborative skills development in PBL. The findings of this study have significant implications for educational practice, particularly in the context of collaborative skills development through PBL (Himes dkk., 2023). The effectiveness of group cooperation, which has been shown to positively impact learning outcomes, emphasizes the importance of focusing efforts on improving group dynamics in PBL. This indicates that educational institutions must prioritize collaborative skills development among students, which is essential for academic success and career readiness.

Based on the quantitative and qualitative analysis results, this study suggests that education and training in effective communication, shared leadership, and equitable distribution of tasks should be significant components in PBL programs (Y. Yan dkk., 2023). Including these aspects in the curriculum will facilitate the formation of more efficient and harmonious working groups, thus maximizing the potential of collaborative learning. It will also help students develop essential skills such as negotiation, decision-making, and conflict management.

Implementing these strategies in PBL will lead to more inclusive and participatory learning. By allowing students to play an active role in the learning process, they can develop a sense of ownership of their learning. This not only increases student motivation and engagement but also helps in the formation of a deeper understanding of the subject matter.

In addition, integrating collaborative skills education in PBL will help students develop skills in high demand in the world of work. These skills have become essential in modern

work environments, which often demand cross-disciplinary collaboration and the ability to work effectively in teams. Therefore, learning experiences that reinforce these skills will be invaluable to students in their preparation for a professional future.

This research provides valuable insights for education policymakers and PBL practitioners to reflect on and evaluate their cohort learning practices. Education can become more adaptive to student learning needs through adjustments and improvements to curriculum and learning methodologies. Thus, these findings significantly contribute to developing more effective and responsive higher education (Aler Tubella dkk., 2024)

The role of communication, conflict management, and shared leadership in improving group effectiveness.

The findings of this study confirm that effective communication plays a crucial role in improving the effectiveness of group cooperation in the context of PBL. Open and efficient communication between group members has been shown to facilitate the exchange of ideas and information and help clarify shared goals and expectations. This is consistent with the findings of a recent study showing that effective communication is key to creating a productive and supportive collaborative learning environment.

Research found the importance of conflict management in improving group performance. If managed well, conflict can be a source of innovative ideas and solutions. These findings suggest that groups with mechanisms to constructively identify and handle conflict tend to be more effective and harmonious. This gives importance to developing conflict management skills among students to maximize the potential of collaborative learning.

Shared leadership has also emerged as an essential factor in the effectiveness of group cooperation. The study found that when group members take turns leading or have the opportunity to lead certain aspects of the project, this fosters a sense of shared responsibility and increases engagement. This inclusive and democratic approach to leadership encourages all members to actively contribute, reinforcing group dynamics and overall learning outcomes.

Effective communication in group cooperation requires a more in-depth approach to the educational curriculum. This involves developing students' communicative skills, such as active listening, expressing opinions clearly, and providing constructive feedback. In the context of PBL, where students often face complex and challenging tasks, communicating effectively is critical to successful collaboration.

On the other hand, conflict management in group cooperation requires understanding that conflict is not necessarily negative but can be a catalyst for growth and innovation. Therefore, teaching and training in conflict management should focus on identifying, understanding, and constructively resolving conflicts. This will strengthen students' capacity to handle differences of opinion and find standard solutions that benefit all parties.

Co-leadership in PBL learning groups requires a paradigm shift in traditional teaching (Aidoo, 2023). This means enabling students to take on leadership roles and make decisions together instead of following rigid instructions from an educator. This approach promotes the development of leadership skills among students, preparing them for future work environments that often require adaptive and collaborative leadership skills.

Despite the positive results, the study acknowledges that implementing effective communication, constructive conflict management, and co-leadership in PBL practices may meet specific challenges (Y. Yan dkk., 2023). These challenges include resistance from students accustomed to traditional learning methods and the need for additional resources for training and developing these skills. A careful and structured approach is needed to integrate these aspects into the PBL program.

Effective implementation of these aspects also requires commitment from educational institutions to provide adequate resources and support. This includes training for educators in designing and managing collaborative learning and providing platforms and tools to support effective communication and conflict management in study groups.

Strengthening understanding of group cooperation

The findings of this study make a meaningful contribution to educational theory, particularly in the context of group cooperation in PBL. The results of this study show that effective group cooperation significantly impacts achieving better learning outcomes. This reinforces existing theories about the importance of social and collaborative interaction in the learning process. Furthermore, the study underscores that group cooperation is an additional activity and an integral component of effective learning.

The quantitative and qualitative analyses explain how group dynamics affect learning, including communication, leadership, and task distribution. These findings add to the educational literature by providing empirical evidence on specific factors affecting the effectiveness of group cooperation in PBL (Y. Yan dkk., 2023). This challenges conventional understanding and encourages further research into how these aspects can be optimized in educational contexts.

The research also extends the theory of social learning and constructivism by showing that effective learning occurs in the context of supportive group cooperation. This confirms that learning is a social and collaborative process where knowledge is built through student interaction and discussion. These findings contribute to developing curriculum and teaching strategies focusing on collaborative learning.

In addition, the study offers a new perspective on the role of conflict management and shared leadership in-group cooperation. It provides a deeper understanding of how these aspects can be improved in educational practice to improve group performance. These findings enrich theories about group dynamics in education and offer practical guidance for developing relevant skills among college students.

The research found new thinking about how educational institutions can be more effective in designing and implementing PBL programs by understanding the factors that influence the effectiveness of group cooperation, educators can develop more appropriate strategies to support collaborative learning. This enriches educational practices and helps prepare students with the necessary skills for future success (Pozuelo-Muñoz dkk., 2023).

The findings of this study make an essential contribution to the development of educational theory, especially in the context of collaborative learning. The results of this study confirm that practical group cooperation plays a vital role in maximizing learning outcomes in PBL. This suggests that modern educational theory should emphasize the collaborative aspects of learning, which enhance knowledge and develop students' social and professional skills.

Research strengthens understanding of how group dynamics affect learning. Findings on the importance of effective communication, shared leadership, and an even distribution of tasks provide valuable insights for educational theory. This suggests that a holistic approach to collaborative learning, considering these aspects, can lead to more effective and satisfying learning outcomes.

This research challenges conventional understandings of the structure and function of group cooperation in education. These findings suggest that flexible group structures, in which leadership and tasks are shared equally, can be more effective than hierarchical or rigid group structures. This significantly contributes to collaborative learning theory, demonstrating the need for a more adaptive and responsive approach to individual and group needs.

Furthermore, the study highlights the critical role of conflict management in study groups. In collaborative learning theory, conflict management is often not given enough attention. These findings suggest that understanding and managing conflict effectively is key to creating a harmonious and productive learning environment. Developing conflict management skills should be integral to curriculum and learning methodologies.

The study invites policymakers and education practitioners to reflect on and apply these findings in their learning practices. By integrating insights from this research into curriculum design and teaching strategies, education can be more effective in preparing students for real-world challenges. Therefore, these findings enrich educational theory and help develop more efficient and effective educational practices.

Research Limitations

One methodological limitation in this study was the use of limited samples to students from one university. Although this sample includes students from various disciplines, the results may not fully reflect student experiences at other institutions or in different educational contexts. This limitation has the potential to affect the generalization of research findings. Therefore, the results of this study must be interpreted, taking into account the specific context in which the research was conducted.

Furthermore, the study relied on self-assessment and peer assessment instruments that may be affected by subjectivity bias. Although efforts have been made to improve the validity and reliability of the instruments, it is still possible that students' perceptions may influence their answers. This can affect the accuracy of the data collected, especially in measuring the effectiveness of group cooperation and internal group dynamics.

The use of *mixed methods*, although providing comprehensive insights, also has limitations(X. Yan dkk., 2023) Qualitative analysis mainly relies on the interpretation of the researcher, which may introduce subjective biases in the interpretation of the data. Therefore, it is essential to evaluate qualitative results in the methodological context used and consider possible biases in interpretation. Nonetheless, this study makes a valuable contribution to the understanding of group cooperation in PBL and paves the way for further research that can address these limitations.

CONCLUSION

This study successfully provides empirical evidence that corroborates the importance of group cooperation in the context of PBL. Through quantitative and qualitative data, this study shows that effective group work significantly improves student learning outcomes. These findings confirm that group cooperation is not just an additional component but a key element in an effective and holistic learning process in PBL.

The contribution of this research to the understanding and practice of education in the context of PBL is significant. By highlighting factors such as effective communication, shared leadership, and equitable distribution of tasks, the study provides practical insights into how to design and implement learning strategies that strengthen group cooperation. This helps educators to design more memorable and effective learning experiences for students.

Given the findings and limitations of this study, several areas could be explored further in future studies. Further research can investigate the effectiveness of group cooperation in various educational contexts and disciplines. In addition, future research may focus on developing and validating specific interventions aimed at improving collaborative skills and group dynamics in PBL.

Suggestions for future studies based on current research findings and limitations include applying more diverse methodologies and using a more comprehensive and heterogeneous sample. Future research could also integrate longitudinal approaches to understand how group cooperation and collaborative skills dynamics develop over time. Thus, future studies may provide a more comprehensive and in-depth view of how group cooperation affects learning in PBL.

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