



Peer-Supported Informal Learning in Esports: An Analysis of Mobile Legends YouTube Tutorial Comments

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Article History:

Received: May 04, 2026

Revised: May 12, 2026

Accepted: Jul 06, 2026

Online First: Jul 27, 2026

Keywords:

Educational Content Analysis,
Esports Education,
Informal Learning,
Peer-Supported Learning,
Youtube Comments.

Kata Kunci:

Analisis Isi Pendidikan,
Komentar Youtube,
Pembelajaran Antarteman,
Pembelajaran Informal,
Pendidikan Esports.

How to cite:

Kusuma, P. V., & Sari, D. P. (2026). Peer-Supported Informal Learning in Esports: An Analysis of Mobile Legends YouTube Tutorial Comments. *Edunesia : Jurnal Ilmiah Pendidikan*, 7(3), 1750-1767.

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Abstract: This study examines how YouTube comment spaces attached to Mobile Legends tutorial videos contain observable traces of peer-supported informal learning. Using an exploratory mixed-method design, the study analyzed 3,805 cleaned public comments collected from 32 Indonesian-language tutorial videos across 15 channels. Data were examined through codebook-based educational content analysis, supported by descriptive thematic mapping of gameplay topics and interaction tone. The codebook focused on questioning, clarification, experience sharing, peer advice, learning evaluation, and learning difficulty; coding credibility was addressed through expert review, pilot coding, and intercoder reliability reporting. The findings show that 1,156 comments (30.38%) contained explicit informal learning indicators, while 206 comments (5.41%) expressed learning difficulties. Questioning was the most visible learning act, and the most frequent difficulty concerned transferring tutorial knowledge into actual matches. The study contributes by reframing YouTube comments as observable educational traces rather than simple engagement indicators. Practically, the findings suggest that tutorial creators can use comment patterns to design more scaffolded, conditional, and practice-oriented explanations.

Abstrak: Penelitian ini mengkaji bagaimana ruang komentar YouTube pada video tutorial Mobile Legends memuat jejak pembelajaran informal yang didukung oleh interaksi antarteman. Dengan desain mixed-method eksploratif, penelitian menganalisis 3.805 komentar publik yang telah dibersihkan dari 32 video tutorial berbahasa Indonesia pada 15 kanal. Data dianalisis menggunakan analisis isi pendidikan berbasis codebook, didukung pemetaan tematik deskriptif atas topik gameplay dan nada interaksi. Codebook mencakup bertanya, klarifikasi, berbagi pengalaman, saran antarpemain, evaluasi belajar, dan kendala belajar; kredibilitas coding diperkuat melalui validasi ahli, pilot coding, dan pelaporan reliabilitas antar-coder. Hasil menunjukkan 1.156 komentar (30,38%) memuat indikator pembelajaran informal, sedangkan 206 komentar (5,41%) menunjukkan kendala belajar. Aktivitas belajar yang paling tampak adalah bertanya, dan kendala paling dominan terkait transfer pengetahuan tutorial ke situasi pertandingan nyata. Kontribusi penelitian ini adalah menafsirkan ulang komentar YouTube sebagai jejak pendidikan yang dapat diamati, bukan sekadar indikator engagement. Secara praktis, pola komentar dapat membantu kreator merancang tutorial yang lebih bertahap, kondisional, dan berorientasi praktik.

A. Introduction

Digital learning no longer occurs exclusively in classrooms, learning management systems, or formally designed instructional settings. Increasingly, learners rely on open digital platforms to search for explanations, observe demonstrations, compare experiences, and seek clarification when formal instruction is unavailable, insufficient, or unable to address context-specific learning needs. This transformation has broadened the concept of learning environments from institutionally controlled spaces to platform-mediated ecosystems shaped by interactions among learners, content creators, and online communities. Consequently, learning is increasingly understood as a socially distributed and participatory process rather than an activity confined to formal educational institutions. Social media exemplifies this transformation by blurring the boundaries between formal and informal learning through continuous knowledge sharing, collaborative problem-solving, and community participation (Jenkins et al., 2009; Greenhow & Lewin, 2016; Schneider et al., 2022).

The importance of investigating platform-based informal learning is particularly evident in Indonesia, where digital media consumption and esports participation continue to grow rapidly. According to DataReportal (2026), Indonesia had approximately 230 million internet users in October 2025, while YouTube reached 151 million users, representing 52.7% of the national population and 65.5% of all internet users. Simultaneously, Mobile Legends: Bang Bang has become one of the country's most influential esports ecosystems. Esports Charts (2025) reported that MPL Indonesia Season 15 accumulated 113.3 million hours watched and reached a peak audience of 4.13 million viewers, making it the most-watched mobile esports tournament of 2025. These figures suggest that YouTube and Mobile Legends are no longer merely entertainment platforms but have evolved into large-scale digital environments where millions of users access tutorials, exchange tactical knowledge, and participate in collaborative learning activities.

Among contemporary digital platforms, YouTube represents one of the richest environments for self-directed and informal learning (Tadbier & Shoufan, 2021). Its searchable video repository, replay functionality, recommendation system, creator-generated explanations, and interactive comment features enable learners to regulate their own learning processes according to individual goals and prior knowledge. Previous studies have demonstrated that YouTube supports self-directed learning by allowing users to revisit explanations, compare alternative perspectives, and combine video content with social interactions such as commenting, questioning, and knowledge sharing (Joa et al., 2023; Lijo et al., 2022; Nishioka, 2023; Quintero-Rodriguez & Colas-Bravo, 2024). Likewise, digital media have been shown to enhance learner engagement and participation in informal learning contexts (Tazhenova et al., 2024).

However, the educational potential of YouTube cannot be fully understood by examining video content alone. Learning frequently continues beyond video consumption through interactions in the comment section, where viewers ask questions, negotiate meanings, compare personal experiences, request clarification, challenge explanations, and

collectively construct practical knowledge. Consequently, the comment space functions not merely as a communication channel but also as a social learning environment in which learners externalize their understanding, uncertainties, and problem-solving processes. Previous research has shown that YouTube comments may facilitate knowledge co-construction and collaborative reasoning in informal learning settings (Dubovi & Tabak, 2020), while Möller et al (2024) emphasized that comments constitute valuable social data when educationally meaningful interactions are distinguished from irrelevant online noise.

This perspective becomes particularly relevant in esports communities, where learning extends well beyond gameplay itself. Improving performance in competitive games requires strategic reasoning, contextual decision-making, role specialization, communication, self-regulation, and continuous performance evaluation. Gee (2003) argued that well-designed games promote learning through situated problem solving, identity formation, immediate feedback, and iterative practice. More recent studies have demonstrated that esports participation can foster cognitive, metacognitive, collaborative, and self-regulatory competencies when appropriate learning opportunities are available (Chang et al., 2024; Kleinman et al., 2021; Wallner et al., 2025; Zhong et al., 2022; Zhong et al., 2025).

Within this context, Mobile Legends tutorial videos provide an appropriate setting for investigating informal learning because their comment sections consistently contain discussions about role selection, lane management, rotation strategies, macro play, hero mechanics, itemization, and the practical application of tactical knowledge during actual matches. These discussions require players not only to understand game mechanics but also to interpret contextual situations, negotiate alternative strategies, and adapt tutorial knowledge to dynamic gameplay conditions. Therefore, the primary focus of this study is not Mobile Legends as a digital game itself, but the educational interactions that emerge when players collaboratively interpret, question, evaluate, and refine gameplay knowledge through tutorial comment exchanges.

Although previous studies have established YouTube as a platform for informal learning, digital media as a facilitator of self-directed learning, and esports as a potential learning environment, these three research streams have largely evolved independently. Existing YouTube studies predominantly emphasize learning through video consumption, while esports studies mainly examine gameplay performance, motivation, or skill development. Consequently, limited attention has been paid to how learning processes become socially visible through interactions occurring after video consumption, particularly within tutorial comment spaces. More importantly, previous studies rarely conceptualize comment interactions as observable educational evidence capable of revealing learners' questioning behaviour, knowledge negotiation, peer support, reflective evaluation, and transfer difficulties. As a result, an important knowledge gap remains regarding how naturally occurring learner-generated interactions can be systematically interpreted as indicators of informal learning processes rather than merely measures of engagement, sentiment, or online participation.

To address this gap, the present study proposes a different analytical perspective by positioning YouTube tutorial comments as observable educational traces of peer-supported informal learning. Rather than treating comments as engagement metrics, sentiment data, or computational text-mining objects, this study applies an educational content analysis framework that systematically identifies distinct learning functions, including questioning, clarification, experience sharing, peer advice, learning evaluation, and learning difficulties. Furthermore, the study integrates descriptive mapping of gameplay topics and interaction characteristics to contextualize these learning processes while maintaining an explicit educational technology perspective. In doing so, the study contributes not only empirical evidence from large esports learning community but also a conceptual framework for interpreting public online interactions as authentic manifestations of informal and peer-mediated learning (Braun & Clarke, 2021).

Building upon the identified knowledge gap, this study investigates how peer-supported informal learning emerges within Mobile Legends YouTube tutorial comment spaces. Rather than treating comments merely as indicators of engagement or user participation, this study conceptualizes them as observable educational interactions through which learners ask questions, seek clarification, exchange experiences, provide peer support, negotiate meanings, and reflect on the application of gameplay knowledge. By examining these naturally occurring interactions, the study seeks to identify the forms of peer-supported informal learning that become visible within tutorial comment spaces, explore the learning difficulties viewers encounter when attempting to transfer tutorial knowledge into authentic gameplay situations, and explain how interactions among viewers facilitate knowledge negotiation, peer-supported learning, and the contextual transfer of gameplay knowledge. Through this perspective, the study extends current educational technology research by repositioning YouTube comment spaces as socially mediated learning environments where authentic evidence of informal learning can be systematically observed and interpreted. Furthermore, it introduces an educational content analysis perspective that moves beyond engagement metrics and sentiment analysis, demonstrating how learner-generated interactions can provide meaningful insights into peer-supported learning processes. The findings are expected to contribute both theoretically, by advancing the understanding of informal learning in digital platform ecosystems, and practically, by informing the design of more interactive, learner-centred, and scaffolded educational content for online tutorial communities.

B. Method

This study employed an exploratory mixed-method design in which educational content analysis served as the primary analytical approach, supported by descriptive quantitative mapping to contextualize observed learning patterns. The design was selected because the dataset was sufficiently large to summarize interaction patterns through frequencies and percentages while simultaneously requiring qualitative interpretation to explain the educational functions embedded in viewer comments. Following the mixed-

method framework proposed by Creswell & Creswell (2023), qualitative coding provided interpretive meaning to learner interactions, whereas descriptive statistics enhanced the transparency of category distributions. Inferential statistical analyses were not conducted because the study did not investigate causal relationships, compare experimental groups, or evaluate predictive models. Instead, the analysis focused on systematically identifying observable indicators of informal learning through a transparent and theoretically grounded coding framework.

The data consisted of publicly accessible comments collected from Indonesian-language Mobile Legends tutorial videos on YouTube. Candidate videos were identified using keyword combinations related to tutorial content, macro play, map awareness, draft pick, lane management, role selection, hero mechanics, itemization, and emblem strategies. A purposive sampling strategy was applied to retain videos explicitly intended to improve gameplay knowledge. Videos were included when they were publicly available, presented instructional content in Indonesian, and contained accessible comment sections, whereas entertainment highlights, livestream archives, tournament news, promotional videos, and videos with disabled comments were excluded. This procedure resulted in a corpus of 32 tutorial videos from 15 YouTube channels, generating 4,963 raw comments. Following preprocessing, which removed duplicate entries, spam, advertisements, emoji-only comments, URL-only content, and other non-interpretable text, 3,805 comments were retained for analysis, representing a preprocessing retention rate of 76.67%. The distribution of comments across multiple channels minimized dependence on a single creator while maintaining the contextual relevance of the Indonesian Mobile Legends tutorial ecosystem.

The analytical instrument was a theory-informed codebook developed from the concepts of informal learning, social learning, self-regulated learning, and knowledge co-construction (Bandura, 1977; Dubovi & Tabak, 2020; Li et al., 2023; Zimmerman, 2002). Rather than categorizing comments according to gameplay topics alone, the codebook classified comments based on their educational functions, including questioning, clarification, experience sharing, peer advice, learning evaluation, learning difficulty, and non-educational interaction. To strengthen methodological rigor, the codebook underwent expert review and pilot testing using 400 randomly selected comments (10.51% of the final corpus). Two independent coders applied the operational definitions, resulting in an intercoder agreement of 87.80% and a Cohen's kappa coefficient of 0.80, indicating substantial reliability before full-scale coding. Any discrepancies were resolved through discussion to refine category boundaries and improve coding consistency.

The overall research procedure is illustrated in Figure 1, which summarizes the six sequential stages of the study, beginning with the formulation of the research objectives and inclusion criteria, followed by video identification through keyword-based searches, data collection using the YouTube Data API, corpus preprocessing, codebook-based coding with reliability verification, and finally the interpretation of findings through educational content analysis supported by descriptive mapping. After the validated coding process was completed, the comments were analyzed across four complementary dimensions: the

distribution of informal learning indicators, categories of learning difficulties, dominant gameplay knowledge topics, and interaction characteristics. The study adhered to internet research ethics (Franzke et al., 2020) by analyzing only publicly available comments, anonymizing all illustrative examples, and avoiding the disclosure of usernames or identifiable information. Consequently, the findings should be interpreted as observable evidence of peer-supported informal learning within YouTube tutorial communities rather than as direct measures of learning outcomes or gameplay performance.

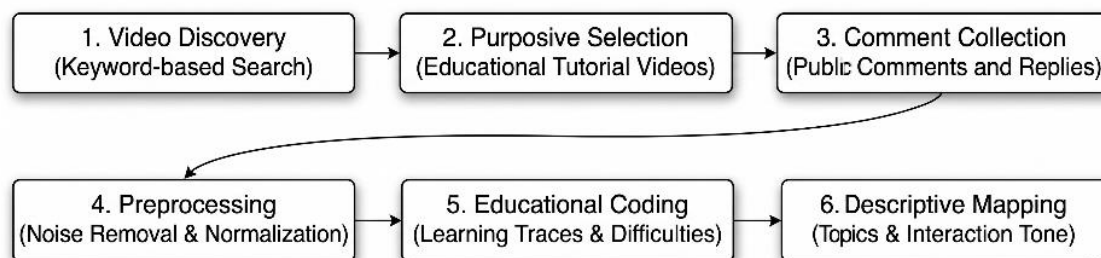


Figure 1. Research Flow of the Educational Content Analysis

C. Result

Corpus Adequacy and Interaction Profile

The final corpus of 3,805 cleaned comments provided a sufficiently rich basis for descriptive educational content analysis. Because the data came from tutorial-oriented videos, the comments naturally contained a mixture of learning-related interaction, social presence, entertainment-oriented remarks, humor, praise, and rank-related banter. The educational question was therefore whether learning-oriented interaction appeared clearly enough to be interpreted as an informal learning phenomenon, not whether every comment was instructional.

The analysis found that learning-oriented comments formed a substantial minority of the corpus. This proportion is important because public comment spaces are not designed as formal classrooms. The presence of structured learning indicators in nearly one-third of the corpus shows that tutorial comment spaces can contain meaningful educational traces while still being embedded in ordinary social media interaction. Figure 2 summarizes the main distribution of learning-related comments, non-educational comments, and difficulty markers.

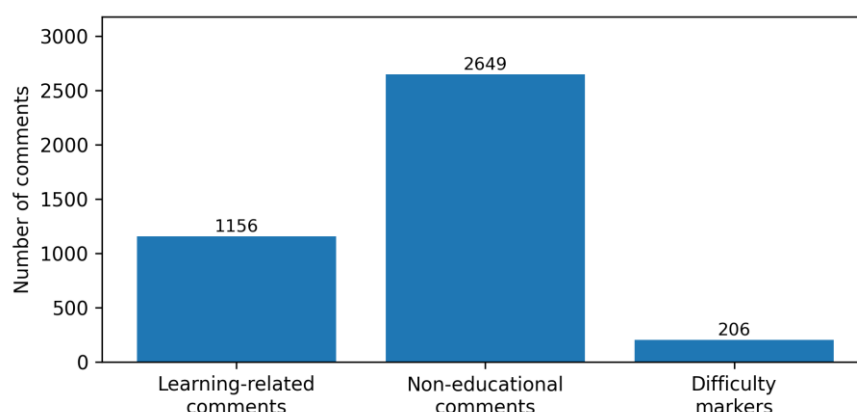


Figure 2. Aggregate Distribution of Learning-Related Comments and Difficulty Markers

Forms of Informal Learning in the Comment Space

The clearest evidence for informal learning came from comments that performed recognizable learning functions. Of the 3,805 cleaned comments, 1,156 comments, or 30.38%, contained explicit informal learning indicators. In contrast, 2,649 comments, or 69.62%, were coded as non-educational because they contained humor, praise, general reactions, rank banter, or unrelated statements without a clear learning function. Table 3 presents the aggregate results.

Table 3. Aggregate Indicators of Informal Learning

Indicator	Count	Interpretive share
Comments coded as learning-related	1,156	30.38% of all comments
Comments coded as non-educational	2,649	69.62% of all comments
Questions within the learning subset	441	38.15% of learning-related comments
Other learning acts: clarification, advice, sharing, evaluation	715	61.85% of learning-related comments
Comments with difficulty markers	206	5.41% of all comments

Table 3 indicates that questioning was the most visible single form of learning activity. The 441 question comments represent 38.15% of the learning-related subset. The remaining 715 learning-related comments consisted of clarification, advice, experience sharing, and learning evaluation. This pattern shows that learning was not restricted to viewer-creator interaction but also occurred through peer exchange among viewers.

Table 4 provides expanded anonymized paraphrased examples of the main learning functions found in the comment space. The examples are not verbatim quotations; they are paraphrased to preserve educational meaning while reducing traceability. Each category includes several examples to show that the coding was based on recurring comment functions, not isolated comments.

Table 4. Paraphrased examples of informal learning functions

Category	Paraphrased Comment Example	Educational Meaning
Questioning	1) "If the roamer is late rotating to turtle, what should the gold lane do?" 2) "When should the exp laner leave lane to help mid?" 3) "Which item should be prioritized if the enemy has two sustain heroes?"	Shows information seeking and learner uncertainty about conditional decisions.
Clarification	1) "So this emblem is better for burst heroes or sustain heroes?" 2) "Does the rotation start after clearing lane or after the first objective appears?" 3) "Is zoning more important than securing the turtle when retri is lost?"	Shows conceptual checking and meaning negotiation.
Experience sharing	1) "In Epic rank this strategy is hard because teammates rarely follow up." 2) "This works when the roamer opens map, but solo queue is different." 3) "I tried this build, but it only worked when the enemy had low crowd control."	Shows situated reflection and transfer attempts from tutorial to gameplay.
Peer advice	1) "If the jungler loses retri, focus on zoning first instead of forcing turtle." 2) "Gold lane should freeze lane if the roamer is helping mid." 3) "Against burst heroes, use a defensive item before forcing war."	Shows peer-supported tactical guidance and distributed expertise.
Learning evaluation	1) "After watching this explanation, I finally understand when to rotate." 2) "This helps because the map example is clearer than just showing gameplay." 3) "Now I know why I should not leave lane too early."	Shows reflection on perceived understanding or usefulness.
Learning difficulty	1) "I understand the explanation, but it is still hard to apply when the team composition changes." 2) "The video is clear, but in match my teammates do not follow the same timing." 3) "The terms are confusing for beginners, especially macro and zoning."	Shows obstacles in conceptual understanding, terminology, or transfer to practice.

The expanded examples show that learning traces were visible not only in direct questions but also in comments that compared tutorial knowledge with actual gameplay. The comment space therefore functioned as a site where viewers tested the conditional meaning of tutorial advice. Figure 3 summarizes the descriptive relation among tutorial input, comment learning acts, peer negotiation, and transfer-oriented learning evidence.

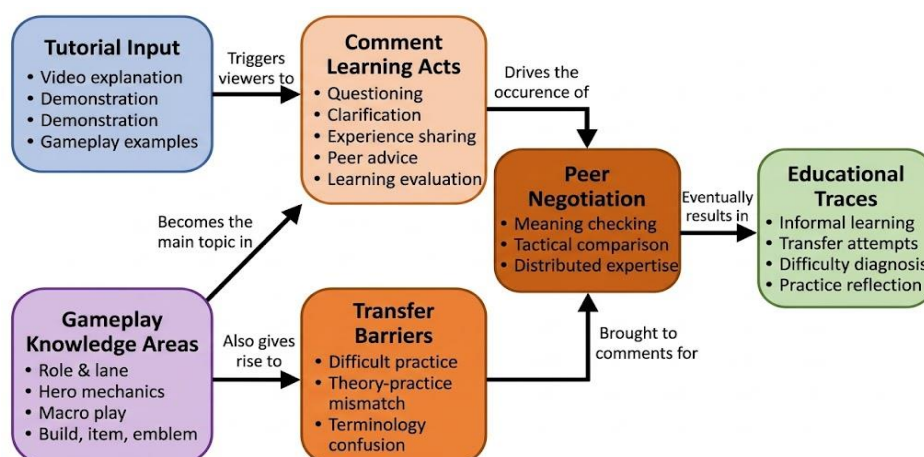


Figure 3. Thematic Relation Model of Peer-Supported Informal Learning in the Comment Space

Questioning and Clarification as Learning Behavior

Questioning was the most frequent visible learning behavior. Questions typically concerned what to do in a specific role, how to respond to delayed rotation, which emblem or item should be used under certain conditions, and when a tutorial strategy should be adapted. Clarification comments extended this process by asking whether viewers had interpreted an explanation correctly. Together, questioning and clarification indicate meaning negotiation rather than passive content consumption.

Peer Advice and Experience Sharing

Peer advice and experience sharing were visible in the learning-related subset and showed how viewers contributed situated knowledge from actual gameplay. Viewers explained that rotation patterns, item choices, or lane responsibilities could change depending on solo-queue coordination, team composition, rank behavior, or enemy pressure. These comments were not formal instruction, but they functioned as peer-supported learning because they added contextual examples, practical warnings, and alternative strategies.

Learning Difficulties and Transfer Problems

The difficulty layer provided the strongest evidence that viewers were not only reacting to videos, but also struggling to transfer tutorial knowledge into practice. A total of 206 comments, or 5.41% of the corpus, contained explicit learning difficulty markers. The largest category was difficult practice, followed by theory-practice mismatch, conceptual confusion, difficult terminology, video too fast, and lack of detail.

Table 5. Distribution of Coded Learning Difficulties

Difficulty Category	Count	Share of Difficulty Comments
Difficult practice	80	38.83%

Difficulty Category	Count	Share of Difficulty Comments
Theory-practice mismatch	57	27.67%
Conceptual confusion	29	14.08%
Difficult terminology	25	12.14%
Video too fast	13	6.31%
Lack of detail	2	0.97%

Table 5 shows that the main learning challenge was not simply understanding the video explanation. The larger issue was applying tutorial advice under actual match conditions. Difficult practice and theory-practice mismatch together accounted for 137 of the 206 difficulty comments, or 66.50% of difficulty markers. This finding indicates that viewers often faced a transfer problem: tutorial knowledge may be understandable in principle, but difficult to implement when team composition, rank behavior, enemy movement, communication, or timing differs from the example shown in the video.

Gameplay Knowledge Areas Discussed by Viewers

Descriptive topic mapping was used to contextualize what kinds of knowledge areas most often discussed by viewers. Role and lane discussion dominated the corpus, followed by hero mechanics, macro play, and build/item/emblem. This distribution shows that the educational content of the comments was concentrated on decision-making areas that require contextual judgment rather than on random entertainment topics.

Table 6. Descriptive Topic Distribution in the Cleaned Comment Corpus

Topic Label	Comments	Share Of Corpus
Role and lane	2,267	59.58%
Hero mechanics	614	16.14%
Macro play	491	12.90%
Build, item, and emblem	433	11.38%

The dominance of role and lane discussion suggests that viewers used comment spaces to discuss functional understanding of the game: who should occupy a lane, when to rotate, how roamer and jungler decisions interact, and how lane responsibility shifts during a match. Hero mechanics comments focused more on execution, while macro play comments concerned objective timing, map pressure, and team movement. Build, item, and emblem comments showed that viewers also sought configurable tactical solutions.

Interaction Tone as Supporting Context

Interaction-tone mapping showed that neutral comments dominated the corpus at 77.98%. This result was interpreted only as supporting context, not as the central finding. In an educational tutorial space, a high neutral tone is plausible because many comments are not written to express like or dislike; they are written to ask, clarify, compare, or give tactical

suggestions. Thus, the tone mapping supports the interpretation that the space was largely informational rather than purely affective. However, because tone mapping was not the main analytic claim, the educational conclusions of this article rely primarily on content categories and paraphrased examples rather than on sentiment classification.

D. Discussion

The findings demonstrate that Mobile Legends YouTube tutorial comment spaces function as meaningful environments for peer-supported informal learning. Observable learning behaviors were reflected through questioning, clarification, experience sharing, peer advice, and learning evaluation, while learning difficulties were primarily associated with transferring tutorial knowledge into authentic gameplay situations. These findings indicate that viewers did not merely consume tutorial content passively but actively engaged in interpreting, evaluating, and adapting gameplay strategies through interactions with other community members. The predominance of questioning further suggests that learners viewed the comment section as a continuation of the learning process, using it to resolve uncertainties, validate their understanding, and seek contextual explanations beyond those provided in the tutorial videos. This pattern reflects the dynamic nature of informal learning, where knowledge construction occurs through continuous interaction rather than one-way information delivery.

The emergence of these learning behaviors can be explained by the contextual complexity of competitive esports. Although tutorial videos present strategic concepts and gameplay demonstrations, real matches involve constantly changing conditions such as team composition, communication quality, map control, player skill, and opponent behavior. Consequently, learners often require additional explanations that address situations not explicitly covered in the original tutorial. The comment section therefore becomes a collaborative problem-solving space in which viewers collectively negotiate meanings, compare experiences, and refine strategies according to their own gameplay contexts. This interpretation is consistent with Bandura (1977) Social Learning Theory, which emphasizes that learning occurs through observation, interaction, and social modelling, as well as Lave & Wenger (1991) Situated Learning Theory, which argues that knowledge develops through participation in authentic communities of practice rather than through isolated instruction. Instead of functioning solely as audiences, viewers became active participants who constructed knowledge collaboratively by questioning, correcting misconceptions, exchanging experiences, and providing tactical recommendations.

These findings are consistent with previous studies identifying YouTube as a platform that supports self-directed and informal learning (Joa et al., 2023; Quintero-Rodriguez & Colas-Bravo, 2024; Tazhenova et al., 2024). However, earlier studies have primarily emphasized the educational value of instructional videos themselves, whereas considerably less attention has been given to the educational processes occurring after video consumption. The present findings demonstrate that learning continues within the comment section, where viewers actively negotiate understanding, evaluate strategies, and

contextualize tutorial knowledge through peer interaction. This interpretation extends the work of Dubovi & Tabak (2020), who demonstrated that YouTube comments facilitate knowledge co-construction, by providing empirical evidence that similar collaborative learning processes also emerge within esports tutorial communities. Knowledge co-construction was particularly evident when viewers discussed whether specific strategies were applicable to different player roles, explained why certain item combinations were effective only under particular circumstances, or compared tutorial recommendations with their own solo-queue experiences. Likewise, the findings support Wallner et al (2025), who argued that competitive gaming skills develop not only through gameplay itself but also through reflective and socially mediated learning activities. By positioning tutorial comment spaces as observable educational environments, this study extends the existing literature beyond analyses of engagement metrics or sentiment classification and demonstrates that learner-generated interactions can serve as authentic evidence of informal learning processes.

An equally important finding concerns the role of peer interaction in supporting knowledge construction. The analysis showed that viewers frequently exchanged advice, challenged existing assumptions, corrected misunderstandings, and shared practical experiences gained from actual matches. Such interactions indicate that learning was distributed across the community rather than relying exclusively on tutorial creators. This collaborative pattern emerged because competitive gameplay rarely follows ideal instructional scenarios. Instead, learners must continually adapt strategies to unpredictable situations, making peer discussion an important mechanism for contextualizing theoretical knowledge. These findings reinforce previous research showing that esports participation contributes to strategic reasoning, self-regulation, collaboration, and the development of twenty-first-century competencies (Chang et al., 2024; Zhong et al., 2022; Zhong et al., 2025). Nevertheless, while previous studies primarily examined structured esports training or formal educational integration (Lee et al., 2020; Reitman et al., 2020), the present study contributes a platform-level perspective by demonstrating that naturally occurring interactions within YouTube tutorial communities also function as educational ecosystems that facilitate collaborative learning without formal instructional design.

The findings should also be interpreted alongside the observation that 69.62% of the analyzed comments were classified as non-educational. Rather than weakening the educational significance of the comment space, this result illustrates the hybrid nature of social media environments, where learning coexists with entertainment, humour, fandom, identity expression, and platform-driven engagement. Public comment sections cannot be regarded as equivalent to formal classrooms because users participate with diverse motivations extending beyond educational purposes. Consequently, educational interactions represent only one dimension of broader social participation. These findings challenge overly optimistic perspectives that equate all online participation with meaningful learning and instead support the argument that educational value depends primarily on the quality of interaction rather than participation alone. In this regard, the

present findings are consistent with Bach & Thiel (2024), who emphasized that effective collaborative learning depends on meaningful interaction rather than simply the existence of online communication. Therefore, the educational potential of tutorial comment spaces depends on how creators, community members, and platform features encourage sustained knowledge-oriented discussions.

Another important contribution of this study concerns the identification of transfer difficulty as the dominant learning challenge experienced by viewers. The majority of difficulty-related comments reflected problems in applying tutorial knowledge during actual gameplay rather than difficulties in understanding the tutorial explanations themselves. This finding indicates that learners generally understood strategic concepts but encountered challenges when adapting them to complex, dynamic, and unpredictable competitive situations. Such transfer difficulties emerged because effective gameplay requires continuous integration of conceptual understanding with rapidly changing contextual information, including teammate coordination, enemy behaviour, objective timing, communication quality, and map conditions. This interpretation supports previous esports research emphasizing the importance of self-regulated learning in competitive gaming (Kleinman et al., 2021) and structured performance development (Nagorsky & Wiemeyer, 2020). However, this study extends previous literature by revealing how learners themselves articulate these transfer difficulties through naturally occurring online interactions. Rather than measuring performance outcomes alone, the findings illuminate the cognitive and contextual barriers encountered during the transition from conceptual understanding to practical implementation. These insights suggest that tutorial creators should incorporate conditional explanations, authentic gameplay scenarios, counterexamples, and reflective prompts to facilitate more effective knowledge transfer.

Finally, this study contributes methodologically by demonstrating that educational content analysis provides a robust approach for investigating informal learning within large-scale online communities. While descriptive mapping was employed to summarize gameplay topics and interaction characteristics, the principal contribution lies in interpreting comments according to their educational functions rather than treating them merely as computational text or engagement indicators. By combining a theoretically informed codebook, systematic coding procedures, expert validation, and intercoder reliability assessment, the study offers a transparent framework for identifying observable learning traces in naturally occurring digital interactions. This perspective broadens the methodological scope of educational technology research by showing that publicly available online comments can serve as credible educational data capable of revealing peer-supported learning processes, knowledge negotiation, and contextual learning transfer. Collectively, these findings advance the understanding of YouTube comment spaces as socially mediated learning environments and provide stronger empirical evidence that informal learning extends beyond video consumption into collaborative interactions among learners themselves.

E. Implication

The findings of this study have theoretical, practical, and methodological implications for educational technology research. Theoretically, the study extends the understanding of informal learning by demonstrating that YouTube tutorial comment spaces function as socially mediated learning environments where peer-supported knowledge construction, meaning negotiation, and contextual learning transfer naturally occur through learner-generated interactions. This perspective broadens the conceptualization of digital learning environments beyond instructional videos themselves by highlighting the educational significance of post-viewing interactions within online communities. Practically, the findings suggest that tutorial creators should design instructional content that anticipates learners' contextual challenges by incorporating conditional explanations, authentic gameplay scenarios, reflective prompts, and scaffolded guidance that support the transfer of conceptual knowledge into real gameplay situations. In addition, educators may utilize esports tutorial communities as authentic learning resources to promote digital literacy, critical evaluation of online information, collaborative problem-solving, and self-directed learning, while platform developers may enhance educational engagement by introducing features that prioritize meaningful learning interactions, such as creator-curated question threads, pinned educational discussions, or peer-verified responses. Methodologically, this study demonstrates that educational content analysis provides a rigorous and transparent approach for investigating large-scale learner-generated interactions, offering an alternative to engagement metrics and computational text-mining by emphasizing observable educational functions, validated coding procedures, and theoretically grounded interpretation. Collectively, these implications contribute to the development of more learner-centred, collaborative, and evidence-informed digital learning ecosystems in which online community interactions are recognized as valuable sources of authentic informal learning.

F. Limitation and Suggestion for Further Research

This study has several limitations that should be considered when interpreting its findings. First, the analysis was limited to publicly available comments from selected Indonesian-language Mobile Legends tutorial videos on YouTube; therefore, the findings should not be generalized to all esports communities, tutorial genres, or digital learning platforms. Second, although the study identified observable traces of peer-supported informal learning, comment-based analysis cannot determine whether viewers actually improved their gameplay or retained knowledge over time. In addition, the absence of demographic information, such as age, educational background, gaming experience, player rank, and frequency of tutorial use, prevented a deeper examination of how individual characteristics may influence informal learning behaviors. Finally, while the use of anonymized paraphrases and a validated codebook strengthened ethical integrity and

analytical reliability, the interpretation remained dependent on educational content analysis rather than direct observation of learners' cognitive processes.

Future research should extend this work by adopting mixed-method or longitudinal approaches that combine comment analysis with interviews, surveys, gameplay observations, screen-recording analysis, or performance assessments to examine how peer-supported interactions influence actual learning outcomes and skill development. Comparative studies across different esports titles, tutorial genres, creator characteristics, player skill levels, and social media platforms such as Discord, Twitch, TikTok, or Facebook Gaming would also provide a broader understanding of how platform affordances shape informal learning processes. Furthermore, integrating educational content analysis with computational techniques, such as natural language processing or social network analysis, may reveal larger interaction patterns while preserving educational interpretation. Such investigations would contribute to a more comprehensive understanding of how digital communities support collaborative knowledge construction and facilitate the transfer of learning across diverse online learning environments.

G. Conclusion

This study demonstrates that Mobile Legends YouTube tutorial comment spaces function as meaningful environments for peer-supported informal learning, where learners actively construct knowledge through questioning, clarification, experience sharing, peer advice, and reflective evaluation. Rather than serving merely as indicators of user engagement, tutorial comments provide observable educational evidence of how learners negotiate meaning, address learning difficulties, and adapt tutorial knowledge to authentic gameplay contexts. The findings further reveal that the primary challenge experienced by viewers lies not in understanding tutorial content itself but in transferring conceptual knowledge to dynamic and unpredictable match situations, highlighting the importance of contextualized learning support. By repositioning YouTube comment spaces as socially mediated learning environments, this study extends the literature on informal learning and educational technology through an educational content analysis perspective that emphasizes learner-generated interactions as authentic learning traces. These findings offer practical insights for tutorial creators, educators, and platform developers to design more interactive, scaffolded, and learner-centred digital learning experiences, while also providing a theoretical foundation for future investigations into collaborative learning processes within online communities and other digital learning ecosystems.

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