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LIGHTS, CAMERA, ACTIVITY! A SYSTEMATIC REVIEW OF RESEARCH ON LEARNER-GENERATED VIDEOS

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ABSTRACT

Aim/Purpose	The current literature discusses the use and benefits of learner-generated videos (LGVs). However, it rarely addresses any correlation between the types of subjects that are best suited for using these videos or what techniques should accompany the use of LGVs.
Background	This systematic review synthesizes current literature to identify patterns and implications that develop from the use of LGVs so that their future use can be both consistent and effective. This paper also reviews the studies to establish the most consistent educational benefits that emerge from this activity.
Methodology	Employing the Preferred-Reporting of Items for Systematic Reviews and Meta-Analyses (PRISMA) technique, this systematic review cumulated 39 eligible studies published between 2008 to 2020. A set of eligibility criteria guided us in the article selection process, such as the use of LGVs as an assignment, educational settings, publication time frame, and empirical studies. We conducted further steps by searching the articles in major databases, screening, analyzing, and synthesizing the articles.
Contribution	This study expands the literature regarding LGVs-related topics in both research and practical aspects. We have discovered research gaps, suggesting the directions of future studies. Additionally, we provide suggestions for practitioners interested in adopting LGVs.

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Findings	Findings reveal that the use of LGVs may result in reduced cognitive load, increased creativity, increased cross-curricular competencies, learner independence, and the ability to apply knowledge in a meaningful way.
Recommendations for Practitioners	Most of the studies that we reviewed recommended strategies for implementing LGVs into a curriculum to optimize the benefits of LGVs. <ul style="list-style-type: none">• Articulating the learning objectives and aligning the LGV activities with the learning objectives emerges as an important strategy.• Instructors may guide students to commence the LGV project early and stay organized with the tasks required to complete the project, as this type of guidance may help students overcome time-related challenges.• Providing several options for the students to create different designs or formats and select the type of media would promote their creativity.
Recommendations for Researchers	Other scholars may consider exploring group differences in their learning performance by employing an experimental study (e.g., providing specific production rules versus not), including investigating the impact on the learning achievement.
Future Research	Future studies may focus on investigating the impact on cognitive load when students produce LGVs with instructional guidance. Other important variables, such as self-confidence and self-efficacy, that may have played a role in the process of producing LGVs deserve further attention.
Keywords	activity theory, learner-generated content, learner-generated video, social constructivism

INTRODUCTION

Learner-generated videos (LGVs) are video artifacts created by learners. Yet, the success of this instructional technique depends on the execution and planning of the educator. While there is a multitude of tools available to aid learners in this aspect, few guidelines have been established as credible methods to help the educator utilize these methods more efficiently. Recent research notes the lack of guidance educators receive when employing multimedia tools in this faculty (E. Lee, 2011), deserving further exploration (Gallardo-Williams et al., 2020).

The Activity Theory (Engeström, 1999) provides a distinctive guideline that will allow instructors to enable multimodal learning which translates to better retention. When learning complex subjects using few or singular methods, learners may retain less information for recall. In fact, the strength of working memory relies on the interplay of multimodal techniques to incorporate cross-functional processing. Without the variations of attentional demand, learners retain less, especially when processing complex subjects (Oftinger & Camos, 2018). Achievements in complex subjects depend on the strength of the interactions within functional brain capacity, therefore resulting in better performance in these areas (Murphy et al., 2020). The production process of LGVs can enhance the multimodal learning process by encouraging learners to showcase their findings (Reyna et al., 2018), in addition to supporting active learning, guide learners in making meaning, scaffold higher order thinking skills, promote teamwork, as well as learner autonomy (Coulson & Frawley, 2017; Hoban et al., 2015; Kearney & Schuck, 2005).

There is an ample amount of literature available highlighting the wide-range benefits of digital videos as a supplement or even substitute for learning curriculum topics (Fuller & France, 2016; Merkt et al., 2011; Tiernan & Farren, 2017). The benefits of using multimedia tools such as videos in learning

continue to develop as educators integrate such tools within teaching methods. Traditionally, autonomy suggests performance outside of the curriculum and in an individual manner. Learner autonomy can be developed even in a group, and especially when using online media sharing platforms. Through individual accountability, new ideas are created by combining different perspectives, and as a result, peer teaching based on learner understanding develops (Hafner & Miller 2011). In this study, we reviewed 39 articles related to LGVs, aiming to understand the extant research with respect to educational benefits of LGVs, suitable instructional methods to accompany LGVs assignments, and challenges faced by the learners, and the contexts in which LGVs are used as an instructional strategy.

USER-CREATED MEDIA SHARING

There is an attraction to user-created videos, and the strongest example of this can be found among social media sites, namely, YouTube. Aside from entertainment, YouTube is a major hub for educating the public on an infinite number of subjects. Though the use of YouTube is not a requirement of any traditional curriculum, people seeking to learn how to perform a task need only to search the site. A quick search will reveal endless videos that will demonstrate the task in action. Minimal tools are needed to produce a video adequate for the site (Lehman et al., 2010). Further, those who have found methods for completing the tasks are intrinsically motivated to create media that others can view and learn from, regardless of the information is innovative or not. One can find hundreds of YouTube videos covering the same task, using the same methods, and that only differ in presentation. Access to this site is free, and an instructor of any course would be able to utilize the features of this online media source (Dreon et al., 2011).

GROUP DYNAMIC AND COLLABORATION

Working in groups establishes peer interactions, including negotiation, discussion, analyzing, and persuasion (Anderson et al., 2001; Palmgren-Neuvonen & Korkeamaki, 2014). As the learner individually begins to make meaning of a learning event, working as a collective requires them to combine their views and create something new. The research indicates that students feel they have learned more when they collaborate on assignments (Benbunan-Fich & Arbaugh, 2006). Peer collaboration and relations are crucial in enhancing problem-solving skills that emerge from these new creations (Kruger, 1993). To expand upon these problem-solving skills, learners reflect on their thinking. In the construction of creating video tutorials, as they are developing their own understanding of the material, learners make deeper meaning so that they can understand and explain it to others.

UNPACKING LGVs THROUGH SOCIAL CONSTRUCTIVIST LENS AND ACTIVITY THEORY

Drawing from the constructivist perspective, student-generated videos are a way for learners to find deeper meaning within the content and participate in more active learning (Amineh & Asl, 2015). Constructivism encapsulates how learners interpret information to create meaning. Bruner's (1996) description of constructivism goes further in making the connection with discovery learning. This posits that the constructivist approach is necessary to use in teaching methods so that the learners can make sense of the content. The ultimate form of meaning-making is when the knowledge learners construct can be applied to practice. It is the learner's role to build and transform that knowledge (Puntambekar & Hübscher, 2005).

Social constructivism focuses on how learners develop these meanings jointly with their peers (Vygotsky, 1978). Applefield et al. (2016) discuss how social constructivism differs from cognitive constructivism in that the emphasis is on social exchanges to foster cognitive development. The idea that learning is active and not passive underlies the constructivist theory, yet the social aspect adds further interactions with an outside source. These interactions further shape the learners' thinking and knowledge development. It is by this framework that learners ensure knowledge transfer through

creating and sharing content-based videos. When learners create their own tutorial videos, they consider the audience they will be sharing these videos with, and their understanding of a subject develops based on these factors. Also, creating tutorial videos when in a group setting specifically promotes the kind of collaboration that further contributes to learning.

The difficulty in analyzing the results from an online learning environment is due to the other activities that must be observed to know if the goal was met. Unlike behavioral and cognitive methods which utilize a task analysis or other hierarchical checklists, constructivism integrates additional needs of the learner such as who the learners are, what their goals are, what product results, and the larger community in which this transpires. Hence, the activity theory epitomizes these aspects of human activity thinking that are involved so that those activities can forge relationships with one another (Jonassen, 2000). The activity theory presents that learning and doing are one, and that they are driven by intention. The components of the activity theory pyramid (subject, rules, tools, community, object, division of labor) are combined to meet the goal. The activity theory is included in some of the studies to address the dynamics and level of participation that learners have with their peers during the creation and sharing processes of these videos (Chen & Liu, 2012; Doubleday & Wille, 2014). Further, the activity theory allows for LGVs to be used as appropriate assessment tools that examine learner literacy of various subjects. Figure 1 provides a visual of a model of an activity system.

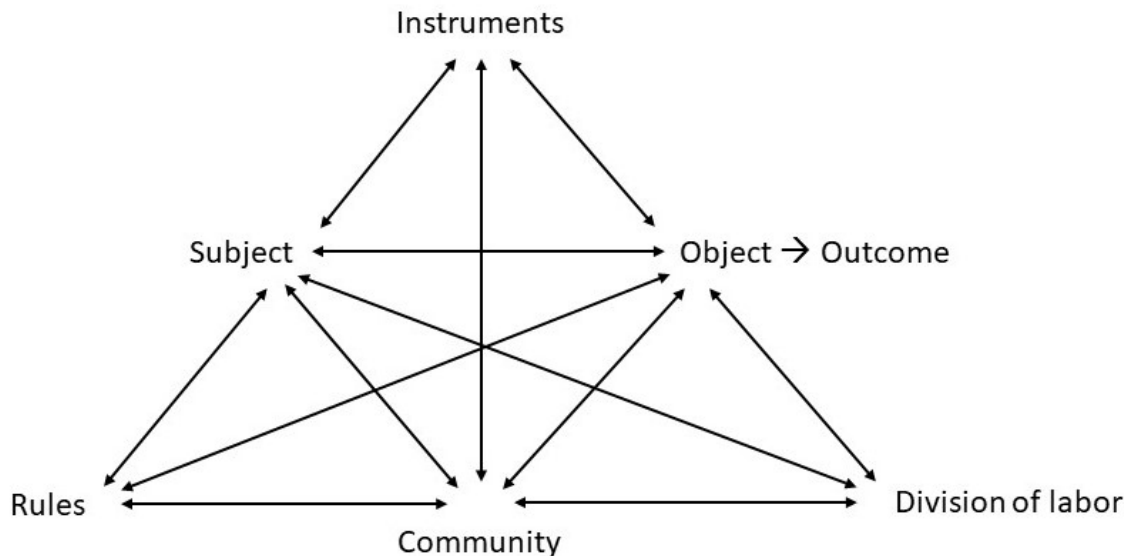


Figure 1. A model of an activity system

Note. Adapted from Engeström (1999, p. 31).

Miller's (1990) framework for clinical knowledge is comprised of four components, including knowledge, observation, simulation, and experience. Within this framework, students can experience problem-based learning by simulation in the form of video-creation to establish that the knowledge was gained. In Omar et al. (2013), students used the videos to show their understanding of roles and behaviors in a dental clinic. Miller's framework calls for learners to show that they have the knowledge, and it is in this mechanism where learner-generated videos can be applied to signify that knowledge has been transferred.

Social learning plays a significant role in the benefit of LGVs since learners develop a transfer of knowledge based on observation or learning the course content, and then simulating or performing to demonstrate the knowledge transfer individually to peers or as they work together in groups to develop the videos. Within a social context, learners begin to understand delegation of activities and how to build a larger picture from smaller contributions of teammates. On an individual level, LGVs

push the learner to consider the audience and understand how to communicate the information according to the audience's needs. As these activities progress, learners are guided through an apprenticeship in which thinking emerges as their peers support them.

Social learning theory goes hand in hand with collaborative creative processing. Dillenbourg (1999) posits that collaborative learning is a form of a social contract that guarantees specific interactions would take place. In brief, collaborative learning refers to the "situation in which particular forms of interaction among people are expected to occur, which would trigger learning mechanisms" (p. 5). A key component of this theory is that this social contract is solidified by an expectation to perform roles within a scenario. As learners develop the content, they can access information from one another that they may not have already had, increasing their working knowledge and aiding in meaning-making from various perspectives. Learners are then required to scaffold their own learning to include their interactions so that they can provide accurate explanations in their videos.

User-created content, specifically digital recording media, employs higher-order thinking skills and provides students the opportunity to create experiences with their peers to facilitate learning and develop communities of practice among peers. Digital videos serve as the perfect vehicle to accomplish this interaction while students take responsibility for learning the topic in ways that they will be able to transfer to their audience.

PURPOSE OF THE STUDY

When learners generate their own content rather than relying on the instructor or publisher-generated content, they are intrinsically motivated to make the effort in learning. They are more engaged and empowered as they develop thinking skills and participate in a wider community (M. J. Lee & McLoughlin, 2007). There is a marked difference between instructor-generated videos and those that learners create. Learner-generated content increases extraneous cognitive processing and encourages generative processing. In contrast, instructor-generated content decreases extraneous cognitive processing and does not further support generative processing (Chen & Liu, 2012). The purpose of this review is to analyze the educational benefits specific to videos created by the learners themselves and the methods that should accompany these assignments that provide the greatest benefit. It also seeks to identify challenges learners face when creating user-generated videos and understand the contexts in which course LGVs are created and utilized as an instructional strategy.

LGVs provide the opportunity for learners to become teachers with their own efforts. To produce these videos, learners must first internalize the information. Then, based on that understanding, learners communicate that meaning to others. Learners can select what information to include in their content, and they can be less distracted by information that they do not consider useful. To do this, learners must become familiar with the information enough to make that choice. These actions foster autonomy in learning and promote self-regulated learning.

While the current literature discusses the use and benefits of LGVs, no group of research distinguishes any correlation between the types of subjects that are best suited for using these videos. Additionally, the techniques that should accompany the use of LGVs should be identified so that their usage can be more effective. As the use of LGVs for academic purposes within a curriculum has only recently been endorsed, it is missing a strong foundation of syntheses that ties the body of research together to amplify the instructional methods and reveals the pronounced benefits and challenges experienced within that setting. This review will synthesize current literature to identify patterns and implications that develop from the use of LGVs so that their future use can be both consistent and effective. This paper also reviews these studies to establish the most consistent educational benefits that emerge from this activity. The following questions are crafted to guide this systematic review:

1. How may studies on LGVs be understood through the lens of the activity theory?
2. What are the major educational benefits of using LGVs ?

3. Which learning contexts have benefitted from the use of LGVs?
4. What are the key challenges learners experience when developing LGVs?
5. What are techniques that should accompany the use of LGVs in a curriculum?

METHODS

Keyword searches were conducted using specific terms pertaining to LGVs to distinguish them from instructor-generated videos. The articles were then reviewed to ensure that the research was data-driven and identified explicit findings. These were also limited to the date range of 2008-2020. (It is worth noting that several studies from 2020 were advance online publications when we conducted the searches. They were then published in an issue when this systematic review was under review.) It was important to include only studies that supplied data that was based on the student perspective and their achievements, rather than benefits to the instructor or an outside audience.

To answer the research questions, selected studies must meet the following criteria:

1. Studies must focus on using learning-generated videos as an assignment or as the means of completing an assignment. Studies using media content created by instructors or from outside sources or learning-generated media of other types were excluded.
2. Studies must include only participants in K-12 and higher education. Studies using LGVs as a part of corporate human performance training or for entertainment purposes were excluded.
3. Studies must provide empirical data through quantitative, qualitative, or mixed methods.
4. Studies must be published in peer-reviewed academic journals spanning from 2009 to 2020 to ensure the most recent and relevant media options were available to the students to create the videos.

SEARCH STRATEGY

Relevant literature was identified using the Preferred-Reporting of Items for Systematic Reviews and Meta-Analyses Statement (PRISMA) (Moher et al., 2009). PRISMA is a 27-item checklist protocol method of scoping quality research studies. Ultimately, PRISMA improves the reporting of systematic reviews and evaluations of studies that should be included and excluded, based on the researchers' own sorting work. PRISMA does not determine what should be included or excluded. Instead, it provides a guideline to help researchers follow an appropriate review process. To ensure the search was inclusive, several databases were searched, but only those that yielded any results with the selected keywords are listed in this article. The databases were: (1) JSTOR, (2) ScienceDirect, (3) Google Scholar, and (4) EBSCO. The keywords used to search the databases included 'student-generated video,' 'learner-generated video.' Also, 'learner-generated content' and 'student-generated content' were used to broaden the search so that articles that did not show up with the aforementioned keywords might show up in this search. Subsequently, the articles were reviewed to find only those which addressed videos only.

Google Scholar returned the highest number of results using the selected keywords. When an appropriate article was found, or one that was close to eligibility but fell short, the 'related articles' and 'cited by' elements were selected, and those results were also viewed for eligibility. The selection of these articles led to the abstract of the article being provided on the source journal's webpage. The abstract was then used to determine the article's eligibility.

SCREENING

Once the initial search was completed, the articles were screened to rule out duplicates. The remaining were then reviewed by abstract to determine if they further met inclusion criteria in a peer-reviewed journal and if the articles discussed student- or learner-generated videos. At this time, all articles that did not address LGVs were excluded (e.g., student-generated content, learner-generated

content, podcast, audio, or other digital methods besides video). At this point, the remaining articles were reviewed to determine if the student-generated videos were used as class assignments to understand course content. Non-course related videos were excluded. Also, if the instructor or publisher created the videos, the study was not included (see Figure 2 for the PRISMA flow chart used to establish study eligibility).

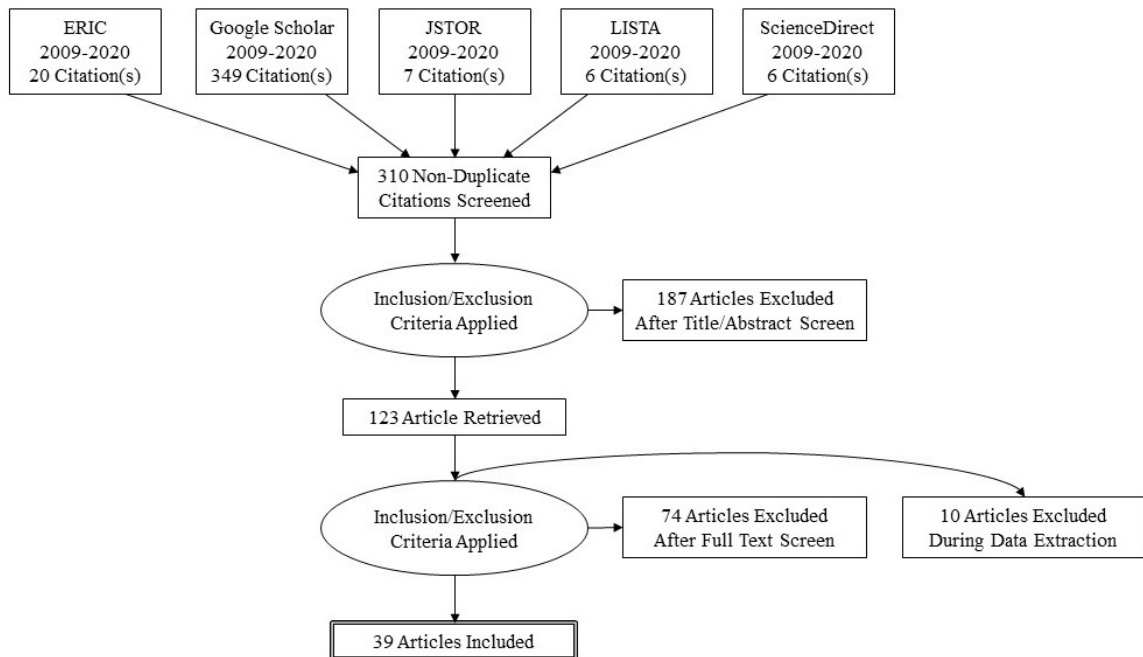


Figure 2. The PRISMA flow chart used to establish study eligibility

ANALYSIS

The remaining studies were deemed eligible if they included the following information to be analyzed: (1) sample size, (2) grade level, (3) research methods used, (4) course subjects in which the videos were used, (5) theoretical framework, (6) length of study, (7) perceived benefits and challenges, and (8) elements of one or more factors of the activity theory. Articles that did not discuss each of these factors were excluded. A thorough reading of the remaining studies resulted in emerging themes in terms of perceived benefits. They were: (1) reduction of cognitive load, (2) expression of creativity, (3) cross-curricular competencies, (4) learner independence, and (5) application.

SELECTED STUDIES

The present review yielded 39 empirical studies of LGVs within K-12 and higher education settings. Table 1 provides an overview of the studies eligible for inclusion. The sample size ranged from 5 to 597, which included single-case studies and groups of multiple classrooms over different semesters. As Table 1 identifies, twenty of the studies were performed at an undergraduate level, while six were conducted at the graduate level and seven were conducted at the K-12 level. Additionally, sixteen of the studies involved the sciences of chemistry and biology, while six were based on math concepts, five were based on language learning, four were based on the liberal arts, and both computer skills and education each had one study based on their subjects.

Table 1. An overview of the reviewed studies

STUDY	SAMPLE SIZE	GRADE LEVEL	METHOD	SUBJECT	PRODUCER CONTEXT	VIDEO ACCESS
1. Aksel and Gurman-Kahraman (2014)	100	K-12	quantitative	language learning	group	online
2. Al Natour and Woo (2021)	353	undergraduate	quantitative	business	group	online
3. Benedict and Pence (2012)	30	undergraduate	qualitative	chemistry	group	online
4. Box et al. (2017)	119	undergraduate	mixed	chemistry	individual	online
5. Chen & Liu (2012)	93	undergraduate	mixed	language learning	individual	online
6. Deaton et al. (2014)	42	undergraduate	qualitative	chemistry	group	online
7. Doubleday and Wille (2014)	21	graduate	mixed	biology	group	online
8. Doyle et al. (2021)	525	undergraduate	quantitative	business	group	online
9. Frenzel et al. (2013)	69	undergraduate	quantitative	chemistry	group	in class
10. Gillette et al. (2017)	282	undergraduate	quantitative	chemistry	individual	online
11. Green et al. (2014)	16	K-12	qualitative	language learning	group	in class
12. Greene and Crespi (2012)	73	undergraduate	mixed	math	group	in class
13. He and Huang (2020)	82	undergraduate	mixed	education	group	online
14. Hulsizer (2016)	9	undergraduates	qualitative	math	group	online
15. Jordan et al. (2016)	71	undergraduate	quant	chemistry	individual	online
16. Kearney (2013)	33	undergraduate	qualitative	education	individual	online
17. Lazarus and Roulet (2013)	23	K-12	qualitative	math	group	in class
18. Martin et al. (2013)	40	undergraduate	qualitative	computers	group	in class
19. Morsch (2017)	65	undergraduate	qualitative	chemistry	both	in class
20. Mui Winnie (2010)	6	K-12	mixed	liberal arts	individual	in class
21. Murray et al. (2017)	70	undergraduate	mixed	math	individual	in class
22. Nikitina (2009)	24	undergraduate	qualitative	language learning	group	in class
23. O'Toole (2013)	10	undergraduate	qualitative	chemistry	individual	in class
24. Omar et al. (2013)	44	graduate	qualitative	biology	individual	in class
25. Palmgren-Neuvonen et al. (2015)	100	K-12	qualitative	various	group	in class
26. Palmgren-Neuvonen and Korkeamäki (2014)	5	K-12	qualitative	language learning	group	online
27. Palmgren-Neuvonen et al. (2017)	30	K-12	qualitative	liberal arts	both	in class
28. Pereira et al. (2014)	29	undergraduate	qualitative	biology	group	in class
29. Pirhonen and Rasi (2017)	19	graduate	qualitative	biology	individual	in class
30. Potter et al. (2021)	160	undergraduate	quantitative	food chemistry	group	in class
31. Reyna and Meier (2020)	1724	undergraduate	mixed	STEM	group	online

STUDY	SAMPLE SIZE	GRADE LEVEL	METHOD	SUBJECT	PRODUCER CONTEXT	VIDEO ACCESS
32. Reyna et al. (2016)	167	graduate	mixed	chemistry	group	in class
33. Ryan (2013)	25	undergraduate	qualitative	chemistry	group	online
34. Snowball and McKenna (2017)	597	graduate		math	group	online
35. Song and Ma (2021)	23	K-12	quantitative	language learning	individual	online
36. Stanley and Zhang (2018)	113	undergraduate	qualitative	math	group	in class
37. Thomas and Marks (2014)	50	graduate	quantitative	liberal arts	group	online
38. Traynor (2020)	not mentioned	undergraduate	mixed	communication and media	both	online
39. Willmott (2015)	138	undergraduate	qualitative	biology	group	online

RESULTS

The studies show that LGVs are being used across disciplines. The context of the subject matter did not affect the general learner perceptions. However, it is helpful to know that LGVs are useful even when learning complex subject matter to engage learners who may be having difficulty grasping the information. Table 2 summarizes the disciplines the studies came from by describing the journal types. Table 3 is a summary of major research topics and main findings.

Table 2. Distribution of selected studies in journals by subject matter

JOURNAL SUBJECT MATTER	N	AUTHORS
Chemistry Science	7	Aksel and Gurman-Kahraman (2014); Benedict and Pence (2012); Box et al. (2017); Frenzel et al. (2013); Gillette et al. (2017); Jordan et al. (2016); O'Toole (2013)
Biology	4	Doubleday and Wille (2014); Omar et al. (2013); Pirhonen and Rasi (2017); Willmott (2015)
Business	2	Al Natour and Woo (2021); Traynor (2020)
Education	23	Chen and Liu (2012); Deaton et al. (2014); Doyle et al. (2021); Greene and Crespi (2012); Green et al. (2014); He and Huang (2020); Hulsizer (2016); Kearney (2013); Lazarus and Roulet (2013); Martin et al. (2013); Morsch, (2017); Murray et al. (2017); Nikitina (2009); Potter et al. (2021); Snowball and McKenna (2017); Palmgren-Neuvonen et al. (2015); Palmgren-Neuvonen and Korkeamäki, (2014); Palmgren-Neuvonen et al. (2017); Reyna and Meier (2020); Reyna et al. (2016); Ryan (2013); Song and Ma (2021); Stanley and Zhang (2018)
Computer Science	3	Mui Winnie (2010); Pereira et al. (2014); Thomas and Marks (2014)
TOTAL	39	

Table 3. Summary of major research topics and main findings

TOPICS	MAIN FINDINGS
Profile of studies	19/39 (48.8%) of the studies were exploratory and focused on descriptive factors. These studies focused on qualitative data such as interviews, questionnaires, and surveys about learner perceptions on using LGVs to learn content. 10/39 (25.6%) of the studies employed a mixed-methods format, and 9/39 (23%) of the studies focused on quantitative methods, specifically test scores.
Educational benefits	Themes emerged, which described benefits of LGVs, including reduction of cognitive load, increase in creativity, increased cross-curriculum competencies, learner independence, and ability to apply knowledge in a meaningful way.
Ways LGVs were used	<ul style="list-style-type: none"> • Exam study guide: learners selected content to create videos on that would aid them in studying for the exam. • Standalone assignments: learners used content that was provided within the course to showcase an understanding of the topic as it is learned within the course in capstone format. • Tutorials for peers and themselves: learners selected material that was not already chosen by others to develop the LGV • Online video/content: about 50% of the projects created videos to be uploaded to an online platform (e.g, YouTube). Course instructors created central pages for learners to place their videos. • Within course: about 50% of the projects used the LGVs in-class only and shared only among peers within the course
Usage contexts	The studies covered many subject areas, including chemistry, biology, math, education, liberal arts, and computer science.
Challenges	Themes in challenges also emerged, including not having enough skill to use the technology, not having enough time to develop the skill, lack of immediate feedback, and variability in ability.
Accompanying techniques	Techniques that should be included when assigning video projects include providing instructions or basic training for video recording, providing content for referencing, a framework for immediate feedback, and periodic check-ins

Additionally, we synthesized and grouped the findings according to the four RQs: (1) how the studies on LGVs are understood through the lens of the activity theory; (2) the major educational benefits of using LGVs; (3) the learning contexts that have benefitted from the use of LGVs; (4) the key challenges learners experience when developing LGVs; and (5) the techniques that should accompany the use of LGVs in a curriculum.

RQ1: APPLYING THE ACTIVITY THEORY

The activity theory describes that learning and the activity performed are intertwined, and they are directed by the goal (Jonassen, 2000). Several components of the activity theory are instruments, subject, rules, community, division of labor and outcomes, which are interconnected to achieve the goal.

The *instruments* component describes the tools used to record the LGVs. There were two main tools noted, either video cameras or iPads. The *subject* actor describes the types of participants engaging in the activity. In this instance, the subjects varied within the category, resulting in sub and overlapping groups. Here, the grade level of participants is distinguished along with whether the participants worked individually, in groups, or both. The studies also differed in defining *rules* to govern the development of the LGVs. A select group of studies did have participants who were provided with guidance and references to create the LGVs, while others were not. In terms of *community*, the studies also revealed a trend in where the LGVs were shared. Ten of the studies submitted the LGVs to an online environment, while the remainder used the LGVs solely to share with peers within the course. The *division of labor* addressed the selection of roles within those studies that had participants work in groups. In these instances, the groups themselves developed a dynamic of assigning individuals to take on certain roles. The remainder of the groups did not specifically delegate roles, but one study in which roles were not delegated reported that in hindsight, participants regretted not doing so (Doubleday & Wille, 2014). Finally, the *outcomes* of the studies differed in the purpose of the LGVs. Based on the review, there were three descriptions of the LGV purposes. Six of the studies used the LGVs solely for a class tutorial, and one used the LGVs as an exam study guide. All others were used as class assignments, not as a capstone activity, to teach others, or as a study guide. Table 4 specifies how each study fits within the activity theory model.

Table 4. Distribution of selected studies in journals by subject matter

THEORY COMPONENT	DESCRIPTION	STUDY
Instruments	Video camera	Aksel and Gürman-Kahraman (2014); Benedict and Pence (2012); Box et al. (2017); Chen and Liu (2012); Frenzel et al. (2013); Gillette et al. (2017); Green et al. (2014); Greene and Crespi (2012); Hulsizer (2016); Jordan et al. (2016); Kearney (2013); Lazarus and Roulet (2013); Martin et al. (2013); Mui Winnie (2010); Murray et al. (2017); Nikitina (2009); O'Toole (2013); Omar et al. (2013); Palmgren-Neuvonen et al. (2015); Palmgren-Neuvonen et al. (2017); Palmgren-Neuvonen and Korkeamäki (2014); Pereira et al. (2014); Pirhonen and Rasi (2017); Reyna et al. (2016); Ryan (2013); Snowball and McKenna (2017); Stanley and Zhang (2018); Thomas and Marks (2014); Willmott (2015)
	iPad	Deaton et al. (2014); Doubleday and Wille (2014); Morsch (2017)
Subjects	K-12	Aksel and Gürman-Kahraman (2014); Green et al. (2014); Lazarus and Roulet (2013); Mui Winnie (2010); Palmgren-Neuvonen, Jaakkola, and Korkeamäki (2015); Palmgren-Neuvonen et al. (2017); Palmgren-Neuvonen and Korkeamäki (2014); Song and Ma (2021)
	undergraduate	Al Natour and Woo (2021); Benedict and Pence (2012); Box et al. (2017); Deaton et al. (2014); Doyle et al. (2021); Frenzel et al. (2013); Gillette et al. (2017); Greene and Crespi (2012); He and Huang (2020); Hulsizer (2016); Jordan et al. (2016); Kearney (2013); Martin et al. (2013); Morsch (2017); Mui Winnie (2010); Murray et al. (2017); Nikitina (2009); O'Toole (2013); Pereira et al. (2014); Ryan (2013); Reyna and Meier (2020); Stanley and Zhang (2018); Traynor (2020); Willmott (2015)
	graduate	Doubleday and Wille (2014); Omar et al. (2013); Pirhonen and Rasi (2017); Reyna et al. (2016); Snowball and McKenna (2017); Thomas and Marks (2014)

THEORY COMPONENT	DESCRIPTION	STUDY
	groups	Aksel and Gürman-Kahraman (2014); Al Natour and Woo (2021); Benedict and Pence (2012); Box et al. (2017); Chen and Liu (2012); Deaton et al. (2014); Doubleday and Wille (2014); Doyle et al. (2021); Frenzel et al. (2013); Green et al. (2014); Greene and Crespi (2012); He and Huang (2020); Hulsizer (2016); Lazarus and Roulet (2013); Martin et al. (2013); Nikitina (2009); Omar et al. (2013); Palmgren-Neuvonen et al. (2015); Palmgren-Neuvonen et al. (2017); Pirhonen and Rasi (2017); Potter et al. (2021); Reyna et al. (2016); Reyna and Meier (2020); Ryan (2013); Snowball and McKenna (2017); Stanley and Zhang (2018); Willmott (2015)
	individual	Box et al. (2017); Chen and Liu (2012); Gillette et al. (2017); Jordan et al. (2016); Kearney (2013); Mui Winnie (2010); Murray et al. (2017); O'Toole (2013); Pereira et al. (2014); Song and Ma (2021); Thomas and Marks (2014)
	both	Morsch (2017); Palmgren-Neuvonen and Korkeamäki (2014); Traynor (2020)
Rules	defined	Benedict and Pence (2012); Box et al. (2017); Deaton et al. (2014); Hulsizer (2016); Jordan et al. (2016); Lazarus and Roulet (2013); Morsch (2017); Mui Winnie (2010); Omar et al. (2013); Pereira et al. (2014); Pirhonen and Rasi (2017); Ryan (2013); Willmott (2015)
Community	in-course	Frenzel et al. (2013); Greene and Crespi (2012); Morsch (2017); Mui Winnie (2010); Murray et al. (2017); Nikitina (2009); O'Toole (2013); Omar et al. (2013); Palmgren-Neuvonen et al. (2017); Palmgren-Neuvonen and Korkeamäki (2014); Pereira et al. (2014); Pirhonen and Rasi (2017); Snowball and McKenna (2017); Thomas and Marks (2014)
	online	Aksel and Gürman-Kahraman (2014); Al Natour and Woo (2021); Benedict and Pence (2012); Box et al. (2017); Chen and Liu (2012); Deaton et al. (2014); Doubleday and Wille (2014); Doyle et al. (2021); Frenzel et al. (2013); Gillette et al. (2017); Green et al. (2014); He and Huang (2020); Hulsizer (2016); Jordan et al. (2016); Kearney (2013); Palmgren-Neuvonen et al. (2015); Reyna et al. (2016); Reyna and Meier (2020); Ryan (2013); Song and Ma (2021); Stanley and Zhang (2018); Traynor (2020); Willmott (2015)
Division of labor	definite role assumption within group	Green et al. (2014); Palmgren-Neuvonen et al. (2015); Palmgren-Neuvonen et al. (2017); Palmgren-Neuvonen and Korkeamäki (2014); Reyna et al. (2016); Snowball and McKenna (2017)
Outcomes	class tutorials	Doubleday and Wille (2014); Gillette et al. (2017); O'Toole (2013); Reyna et al. (2016); Snowball and McKenna (2017); Thomas and Marks (2014)
	exam study-guide	Hulsizer (2016)

RQ2: EDUCATIONAL BENEFITS

The research highlights several benefits of using student-generated videos as a method to enhance knowledge acquisition. The most commonly cited across the board were: (1) reduction of cognitive load (six articles), (2) creativity expression (eight articles), (3) cross-curricular competencies (seven

articles), (4) learner independence (six articles), and (5) application (nine articles). Figure 3 provides a visual of the number of times each benefit was perceived as the main benefit for the studies.

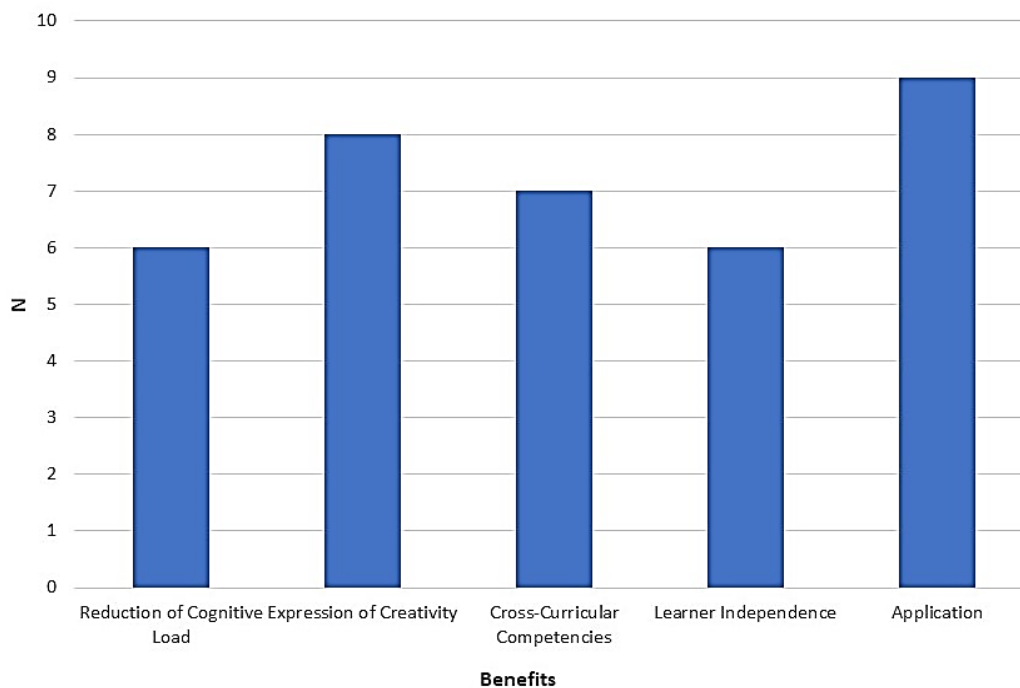


Figure 3. A tabulation of perceived main benefits by study

Reduction of cognitive load

The LGVs supported the reduction of cognitive load through various mechanisms. Gillette et al. (2017) found that when the videos are created in a group setting, the delegation of activities helped the learners become more focused on the specific content they were responsible for individually. Research also finds that creating the videos themselves and developing accurate content allows the learners to think more deeply about the material in ways that the content does not address, leading to more complex questions based on higher-order thinking (Box et al., 2017). Additionally, students used the creation of the videos to transfer theoretical concepts to practical ones more easily, bridging classroom work with real-world practice (Thomas & Marks, 2014).

Creativity expression

The student-generated videos were shown to enhance learners' desire for self-expression and creativity. Lazarus and Roulet (2013) found that in developing algebra skills, the students used many elaborate animations to explain the content. In turn, the students were moved to explore other tools within the application. Learners also considered the audience in terms of accessibility and abilities. This motivated them to use creative measures to accommodate these learners. Moreover, the students themselves mention the aspect of creativity as the most enjoyable part of the project. Using creativity to enhance a complex topic was also an educational benefit, as learners dissected the content and developed original ways to explain it (Greene & Crespi, 2012; Potter et al., 2021).

Cross-curricula competencies

During video development and sharing, students also gained practice in independent learning, cooperation, self-awareness, and processing criticism of themselves and others (Doubleday & Wille, 2014; Omar et al., 2013; Reyna et al., 2016). In addition to the multidiscipline competencies, students are

also exposed to media tools that they may be used for the first time and are more apt to try technology that they have not previously used (Kearney, 2013; Pereira et al., 2014; Pirhonen & Rasi, 2017; Reyna & Meier, 2020; Willmott, 2015).

Learner independence and application

The research also shows a correlation between student-generated videos and a lower need for support from the instructors or teaching assistants. Likewise, since the learners had access to videos from their peers, they were noted to view these when they needed further explanation rather than turning to the traditional textbook materials that they also had access to (Jordan et al., 2016; O’Toole, 2013). Students also saw the benefit of using the video creation process in real-world activities or contexts, either in using the technology tools or giving instruction on a complex subject (Snowball & McKenna, 2017; Song & Ma, 2021).

RQ3: LEARNING CONTEXTS BENEFITTED FROM THE USE OF LGVs

Course subjects receiving enhanced benefits

The course subjects that can utilize student-generated videos ranged from biology to liberal arts studies. Though we have established the journal types in which the articles are shown, it is important to distinguish which subjects are covered. For instance, in an education journal, one may find articles focusing on the education of many subjects, and we wanted to see which particular subjects used the LGVs. Table 5 describes the studies that used student-generated videos categorized by subject.

Table 5. Subjects within the studies that used LGVs

SUBJECT	N	AUTHORS
Business	2	Al Natour and Woo (2021); Doyle et al. (2021)
Biology	5	Doubleday and Wille (2014); Omar et al. (2013); Pereira et al. (2014); Pirhonen and Rasi (2017); Willmott (2015)
Chemistry	11	Benedict and Pence (2012); Box et al. (2017); Deaton et al. (2014); Frenzel et al. (2013); Gillette et al. (2017); Jordan et al. (2016); O’Toole (2013); Morsch (2017); Potter et al. (2021); Reyna et al. (2016); Ryan (2013).
Education	2	He and Huang (2020); Kearney (2013)
Math	6	Greene and Crespi, (2012); Lazarus and Roulet, (2013); Murray et al. (2017); Hulsizer (2016); Snowball and McKenna (2017); Stanley and Zhang (2018)
Liberal Arts	11	Aksel and Gurman-Kahraman (2014); Chen and Liu (2012); Green et al. (2014); Mui Winnie (2010); Nikitina (2009); Palmgren-Neuvonen et al. (2015); Palmgren-Neuvonen and Korkeamäki (2014); Palmgren-Neuvonen, et al. (2017); Song and Ma (2021); Thomas and Marks (2014); Traynor (2020).
Computers	1	Martin et al. (2013)
STEM	1	Reyna and Meier (2020)
TOTAL	39	

Notably, most of the LGVs were completed in STEM subject assignments. About 70% of studies using learner-generated videos were focused on biology, chemistry, math, and other sciences. This reveals the value of this method in subjects that are perceived to be complex. In the case of female and minority inhibition and lower confidence in STEM subjects, LGVs could prove to be a catalyst that would help these groups gain more confidence (Cooper & Heaverlo, 2013; McKenna, 2016; Stevens et al., 2016). Riedinger and Taylor (2016) posit that developing an identity in a subject is vital in

confidence development. As the benefits of these videos include creativity and learner independence, these factors can work together to help these learners build their STEM identities.

Usage content

In the classroom environment, LGVs were used in multiple ways to aid learners with learning new concepts. As a study aid, LGVs provide a low-stakes method of presenting problem solutions to their peers. In a study conducted by Hulsizer (2016), although most learners considered the instructor-led reviews to be more helpful, a majority felt that the LGVs were much more engaging and would be able to use either one as a review source.

Most of the studies utilized LGVs as a standalone assignment, and therefore supported creativity within meaning-making for learners (Potter et al., 2021). As an assignment, learners can use course materials as a reference and determine what information they should include or what information they can exclude because they already know it. In these circumstances, learners noted that the LGVs were more helpful than instructor-led reviews, although the videos were not created specifically for that reason. The assignment LGVs lent to less reliance on instructor assistance (Benedict & Pence, 2012; Jordan et al., 2016; Morsch, 2017).

LGVs as peer tutorials were effective through approaching peers through the learner perspective. As all the learners were understanding the material at the same time, the LGVs included material that would be helpful and less of what would not be. They would even be more likely to explain the terminology in a way that their fellow peers would understand. In the transfer of knowledge, familiarity with one another also meant that they were better able to target their peers' needs because of shared perspectives (Gillette et al., 2017; Thomas & Marks, 2014).

RQ4: CHALLENGES DURING VIDEO DEVELOPMENT AND PRODUCTION

Despite the stated benefits in all the studies reviewed, learners noted challenges they experienced while creating their videos. Four types of challenges emerged from the literature, learners not having an adequate skill to use the technology and not having enough time to develop the skill (He & Huang, 2020; Lazarus & Roulet, 2013; O'Toole, 2013; Stanley & Zhang, 2018). Some learners felt frustration with waiting for feedback on uploads while the variability of skills within groups led to confusion and wasted time. When learners felt they did not have enough video production knowledge, they spent time trying to learn, and that this detracted from the actual project itself (Potter et al., 2021). It also affected their views on role delegation. In group collaborations, the variability in ability resulted in some conflict over what should be done and how it should be done. When the projects were shared in class, feedback was immediate, as opposed to when it was uploaded to an online site (Doubleday & Wille 2014). These challenges were consistent enough to suggest the activity model include the addition of a challenges section so that from then on, those issues could be reviewed for a remedy as it would apply in the next production event. Table 6 identifies which studies noted specific challenges.

Table 6. Summary of noted challenges by type and study

CHALLENGES	STUDIES
Not enough skill to use the technology (unfamiliarity with the tools)	Gillette et al. (2017); Greene and Crespi (2012); He and Huang (2020); Martin et al. (2013); Willmott (2015)
Not enough time to develop the skill (time-consuming)	Lazarus and Roulet (2013); O'Toole (2013); Potter et al. (2021); Stanley and Zhang (2018)
Absence of immediate feedback	Doubleday and Wille (2014)
Variability in ability	Frenzel et al. (2013); Jordan et al. (2016); Thomas and Marks (2014)

RQ5: ACCOMPANYING TECHNIQUES

Gaining the most benefit from LGVs relies on several specifics. First, the instructor should not take for granted the pre-existing knowledge of video creation, even with digital natives. Several studies provided some type of basic video training before the video development (Benedict & Pence, 2012; Box et al., 2017; Deaton et al., 2014; Hulsizer, 2016; Jordan et al., 2016; Lazarus & Roulet, 2013; Morsch, 2017; Mui Winnie, 2010; Omar et al., 2013; Pereira et al., 2014; Pirhonen & Rasi, 2017; Ryan, 2013; Willmott, 2015). The instructions were on varying levels; therefore, future projects involving LGVs should establish how much and what kind of technical training or support in conjunction with the project needs. Participants, who were involved in projects that did not provide any formal classroom training or provide a point of reference where they could learn, mentioned learning curves as a hindrance to the project timeline (Chen & Liu, 2012; Doubleday & Wille, 2014; Frenzel et al., 2013; Gillette et al., 2017; Green et al., 2014; Greene & Crespi, 2012; Kearney, 2013; Martin et al., 2013; Murray et al., 2017; Nikitina, 2009; O'Toole, 2013; Palmgren-Neuvonen et al., 2015; Palmgren-Neuvonen et al., 2017; Palmgren-Neuvonen & Korkeamäki, 2014; Reyna et al., 2016; Snowball & McKenna, 2017; Stanley & Zhang, 2018; Thomas & Marks, 2014). Second, the LGV should be integrated into and considered as a part of a traditional assignment. This supports better learning of the subject and promotes retention while using the traditional materials as a point of reference as the videos are being created (Lazarus & Roulet, 2013; Pirhonen & Rasi, 2017). Third, the curriculum workload should be balanced so that the learners have enough time to work on the video. The extra time will accommodate the effort in developing the video (Potter et al., 2021; Thomas & Marks, 2014). Fourth, learners who posted their videos on online platforms eagerly await feedback, so instructors need to ensure the sharing application used will provide ample feedback in a timely manner or set a timeline for peer feedback as a requirement of the assignment. In a study done by Doubleday and Wille (2014), participation in online collaboration and participation dwindled for this reason. Learners cited that they lost interest in commenting because they felt they would not receive a response and therefore, did not see the need. Additionally, periodic instructor check-ins could allow learners to reflect where they are, receive help if needed, and adjust if necessary.

DISCUSSION

TRENDS IN LGVs LITERATURE

The publication trend establishes the continuance of using LGVs within education. The increase of interactions within communities, both socially and online, has created an explosion of user-created videos that can now be applied within an educational context as LGVs. Benefits that include learner independence, enhanced creativity, cross-competency development, reduction in cognitive load, and application have inspired practitioners to integrate LGVs within courses to reflect on what they have learned so well that they can explain it to others. The younger generation has grown up in a society of selfies and user-generated content, yet most of the literature addresses using LGVs in higher education, indicating that there is still an opportunity to explore LGVs within the K-12 arena. The literature has established that LGVs would be an effective pedagogical approach for any type of learner.

THEORETICAL FRAMEWORKS ACROSS THE LITERATURE

Theoretical frameworks are the structures that support the research completed and show why the findings are significant. Half of the studies did not express a theoretical framework or explain how it was relevant to the study. Those who did, present a trend in framework choice, focusing on activity, constructivist, and social constructivist theories. As LGVs are effective in many ways, a strong theoretical foundation or framework needs to be chosen to justify its use across disciplines, therefore showing its benefit across educational levels (Reyna & Meier, 2020; Song & Ma, 2021). Many other theories exist that could fit the research, but other studies should be completed to determine their appropriateness.

The constructivist theory was the most commonly cited among 40% of the studies when describing the general process of making meaning from information. Yet, this theory leaves room for application across a multitude of pedagogies and is certainly non-specific to digital media, which is of the utmost importance when using LGVs. Forty-five percent of the studies failed to describe how they applied a specific framework to their research. In some cases, the theory was merely listed, but its purpose was not discussed. While those in the field of education may already be familiar with these theories, LGVs can be used across contexts. Therefore, studies that use LGVs should explain these frameworks so that those outside the field of education can better understand the context of their use and the theories can be applied appropriately. This was a missed opportunity to discover other theories that could be beneficial to the LGV projects.

The activity theory was cited only twice (Chen & Liu, 2012; Doubleday & Wille, 2014), yet it appears to be the most appropriate guide to LGV production and usage. Across the studies, the model can be applied to plan for and guide the LGV production so that learners can get the most out of the activity. It also allows projects to be evaluated to determine what the reality of the LGV projects was versus the expectation and thus allows for contraindications for issues that may arise. Still, it is noted that many challenges present themselves within the production of LGVs. Though the studies selected in this review noted various challenges, the model does not provide a step for guidance in these instances. Allowances for contraindications may not be enough to address the consistency of challenges that are reported in the studies, especially for practitioners who are using LGVs for the first time. Therefore, adding an element specifically applying to challenges would be helpful. Considering that LGVs are a relatively new pedagogy, especially in terms of the communities in which they are shared, the unique challenges that arise are expected. By adding this element, LGV projects can begin with these possible encumbrances in mind so that instructors can find ways to avoid or correct them without negatively impacting the learner.

IMPLICATIONS AND RECOMMENDATIONS FOR PRACTITIONERS

The results indicate that LGVs can provide learners with a powerful experience in transforming knowledge into a tangible item. The consistent educational benefits of cognitive load reduction, creativity expression, cross-curricular competencies, learner independence, and application all support the use of this activity. Most of the studies that we reviewed recommended strategies for implementing LGVs into the curriculum to optimize the benefits of LGVs.

First, articulating the learning objectives and aligning the LGV activities with the learning objectives emerges as an important strategy (He & Huang, 2020; Potter et al., 2021). By doing so, instructors can create a corresponding grading rubric to communicate the expectation of the LGV activity – whether it is an individual or team project – for allowing students to self-assess and monitor the project (He & Huang).

Second, instructors may guide students to commence the LGV project early and stay organized with the tasks required to complete the project, as this type of guidance may help students overcome the time-related challenges (He & Huang, 2020; Potter et al., 2021). The caveat is that the instructors may want to be thoughtful about the amount of time required and the video elements included in the assignment (Potter et al., 2021).

Third, providing several options for the students to create different designs or formats and select the media type would promote their creativity (Al Natour & Woo, 2021; Brook & Oliver, 2003; Czerkanski & Lyman, 2016; Potter et al., 2021).

Finally, students need to have communication, collaboration, time-management, and critical-thinking skills in the real world, by which the instructors can promote these skills through LGV assignments (Reyna & Meier, 2020). Communicating the value of these skills to students is achievable by recommending them to include their LGV in their portfolio (Potter et al., 2021). When students transform their LGV into a portfolio artifact, it also provides them with an opportunity to assess and reflect on

their learning process; simultaneously, the portfolio becomes a showcase of the outcomes of mastering the subject matter and honing their skills (Potter et al., 2021).

FUTURE RESEARCH DIRECTIONS

Our synthesis displays the benefits of LGVs in complex STEM subjects, reinforcing the need for LGVs to be important activities in such curriculums. The focus of most of the studies was to determine the learner's perspective in answering questions such as: (a) how learners feel about a learning activity when it is conducted through the lens of the learner; (b) how learners feel about learning from their own peers; and (c) how learners react to assuming the responsibility of their own knowledge transfer. All of these questions and others like them have a psychological and emotional approach to determining the benefits of this form of pedagogy. However, there is not an equivalent number of studies that look at actual grades and compare the performance of experimental and control groups of those who use LGVs to learn a specific topic and those who use the lecture/text format. We can hypothesize that LGVs might lead to better learning retention, yet some studies showed no significant change in performance between groups that used LGVs and those that did not (Gillette et al., 2017), and also studies that reported that only learners who already had higher grades produced higher scores (Stanley & Zhang, 2018). It is important to recall that in addition to the content they were meant to learn, LGVs also provide cross-curricular competencies that were not tested. These studies also did not define or establish guidelines and rules for producing the LGVs to the participants. We could then determine if the addition of rules could relieve some of the cognitive load even further and allow learners to retain and recall more information.

This systematic review has also revealed a need for studies to not only gauge learner performance as pedagogy techniques are compared, but also within those comparisons, provide a guideline for LGV production. It would also be beneficial to know if there is a difference between groups of learners who all used LGVs and simply controlled the factor indicating whether they received guidance (He & Huang, 2020). There were no studies identified that have addressed this need or any comparisons of LGVs with or without production rules. In these opportunities, the Activity theory could be further validated as it pertains to digital media use. Future studies may focus on investigating the impact on cognitive load when students produce LGVs with instructional guidance. Additionally, the impact on learning achievement or outcome can be explored (Song & Ma, 2021). Other important variables, such as self-confidence and self-efficacy, that may have played a role in the process of producing LGVs deserve further attention. The more we understand the dynamic factors of LGVs, the better we can equip learners to be more efficient in their use.

CONCLUSION

Guided by the Activity Theory (Engeström, 1999) and the PRISMA approach, we conducted a systematic literature review to address a research gap related to the LGVs topics. Specifically, the current review focuses on an understanding of LGVs through the Activity Theory, the educational benefits of using LGVs, the learning contexts benefitted from the use of LGVs, key challenges that learners experience when developing LGVs, and the instructional techniques to accompany the use of LGVs in a curriculum. Findings suggest that the use of LGVs offers several educational benefits, such as reduction of cognitive load, promotion of creativity, cross-curricular competencies, learner independence, as well as the ability to apply knowledge in a meaningful way. Although beneficial, learners may encounter challenges when creating their videos, such as not having an adequate skill to use the technology and not having enough time to develop the skill. Most of the studies that we reviewed recommended strategies for implementing LGVs into the curriculum to optimize the benefits of LGVs. For example, articulating the learning objectives and aligning the LGV activities with the learning objectives emerges as an important strategy. Instructors may consider guiding students to commence the LGV project early and stay organized with the tasks required to complete the project, as this type of guidance may help students overcome the challenges. Furthermore, providing several

options for the students to create different designs or formats and select the type of media would promote their creativity. This study expands the literature regarding LGVs-related topics in both research and practical aspects. We have discovered research gaps, suggested the directions of future studies, and provided suggestions for practitioners interested in adopting LGVs.

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