THE LEARNING COMMUNITY AS A MEANS TO ENHANCE PROFESSIONAL SKILLS IN 3D PRODUCTION

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ABSTRACT

This article explores the intersection between university pedagogy and 3D production, addressing the challenges of professional insertion in this field and strategies to develop students' skills. Partial results of an action research project are presented, focusing on the implementation of a learning community to support the development of skills in 3D production in a Bachelor's degree in media creation at a French-speaking university in Quebec, Canada. The analysis of the data, from a group interview with ten students who attended the course, revealed the contributions and limitations of the learning community. In addition, suggestions for future research in the area were identified. This study highlights the importance of innovative pedagogical strategies to prepare students for the ever-evolving job market, particularly in technological sectors such as 3D production. The research also highlights the ongoing need to adapt and improve teaching practices to better meet the demands of society and promote the professional success of undergraduates.

Keywords: University pedagogy. 3D production. Professional skills. Learning community.

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CONTEXT OF THE RESEARCH

Animation, texture, modeling, and lighting are essential concepts in the 3D production process[3]. These specific fields of activity bring together artists with very diverse skills. For these artists, the development of professional skills in 3D production is essential to effectively master and consolidate their art in the long term, ensuring its sustainability.

In the field of 3D production, the production flow – also known as the *production pipeline* – is generally similar from one project to another. The production flow is simply a way of planning production, defining the main stages of the project, which is essential to ensure the professional quality of the final result. According to Pellacini (2007), four main stages can be associated with 3D production: development, pre-production, production and post-production. The development stage involves the conception, writing of the script, the search for style, the management and preparation of the necessary material or personnel. Pre-production consists of preparing the different elements that will be used in the production, including the creation of characters, the construction of scenarios and the layout. The production phase involves staging the project, combining object animation, character animation, simulation, effects, and lighting to finally render. The post-production stage is where the editing of the shots, the composition and the sound take place.

Although Dunlop (2014) recognizes that, depending on the type of production, other stages may be juxtaposed to those described by Pellacini (2007) and therefore complement them (such as, for example, motion capture, special effects, programming, etc.), the professional competencies required to carry out 3D projects are usually associated with each of these main stages (production, post-production, etc.) or with the underlying fields of activity (editing, sound, lighting, etc.) (Gagnon, 2018). A 3D production artist can specialize more specifically in one of these fields or become a versatile artist who has mastered various aspects of professional activity in the field of 3D production.

Currently, the university has stood out as a privileged space for the development of professional skills in various fields of activity (Poland; Santos, 2020). This scenario is no different when it comes to 3D production, which has experienced a significant increase in the number of new university programs around the world. In Quebec, Canada, for example, a few years ago these programs were exclusive to private technical schools, but the situation has changed dramatically in the last decade. Currently, several universities, especially those that make up the *Réseau de l'Université du Québec*, offer bachelor's

[3] 3D is an abbreviation for "three-dimensional," referring to objects that have three dimensions: height, depth, and width. In this article, we will use the expression "3D production" to refer to audiovisual creations that, although projected on a flat screen, give the viewer the impression of three-dimensionality (Chum, 2021)

degree programs in 3D animation, digital design and media creation with a specialization in 3D production.

However, although these programs have become part of the large universities in this Canadian province, it is important to recognize that university education may not be able to develop in students all the professional skills required by 3D production. When we analyze the skills required by the labor market in this area (Gagnon, 2018), we realize that some elements are neglected by training, which focuses more on teaching abstract concepts far from the reality of the profession. This situation can generate conflicts in the student and questions about their role in the area of study. In addition, it can lead to great difficulties in entering a highly competitive and challenging job market. As Chen *et al*. (2021) mention, it is crucial not only to consider the knowledge acquired by students during training, but also what they will be able to do when they join a professional team and are faced with complex and varied situations.

Considering the context, the use of the concept of learning community as a pedagogical device for the development of professional skills in the field of 3D production in the university environment can be an effective approach. The notion of learning community emerged in the 1990s and was proposed by Wenger (1998) based on organizational theories. For this author, knowledge built in a group is the most valuable resource of an organization. The functioning of the group of learners or professionals in a learning community is recognized both by improving the effectiveness of its members, through socially constructed and shared knowledge (Dufour; Eaker, 2005; Orellana, 2015; Roy; Hord, 2006), as well as the fact that it is a tool for the development of collective competences, reduction of isolation, overcoming challenges and improvement of practices (Dione *et al*., 2010; Leclerc; Labelle, 2013; Raby *et al*., 2022). According to Areba, (2021), the notion of collective competencies is fundamental, since the acquisition of many professional competencies is only possible through cooperation. From this perspective, learning to communicate, collaborate, negotiate or even understand is only possible through interaction with peers.

With the growing demand for professionals trained in 3D production, it is essential that trainers adopt innovative and diversified methodologies for the development of professional skills of university students (Dale, 2010). However, unlike other areas of training, such as teacher training, which is well documented (Araújo-Oliveira; Tremblay-Wragg, 2022), the training practices and teaching strategies of university trainers in 3D production are still poorly explored and documented (Gagnon, 2018).

Research on the development of 3D manufacturing skills in Quebec universities is scarce. Although there are several studies on learning communities with students or education professionals (Raby *et al*., 2022; Peters and Savoie-Zajc, 2013; Dionne; Couture, 2013; Hamel *et al*., 2013), the development of professional competencies in 3D production through the implementation of learning communities is an unexplored topic of study. The relevance of this research is not in demonstrating the relevance of the use of a learning community for professional development, as this has been widely documented by other previous studies (Conseil supérieur de l'éducation, 2014; Richard *et al*., 2017). On the contrary, its importance lies in identifying how the implementation of a learning community in a university context can contribute to the development of professional skills of students involved in a 3D production similar to the professional reality. This was the main objective of this action research.

CONCEPTUAL FRAMEWORK

The concept of learning community is fundamental to our reflection. According to Grégoire and Laferrière (1998, p. 572), the learning community, also known as the community of learners, is "[...] a particular organization of the classroom, composed of a group of students and at least one educator, animated by a common vision and will, who seek together the mastery of knowledge, skills or attitudes" (our translation). The learning community places students in a work context similar to the realities experienced in professional 3D production studios, allowing them to pool their efforts, talents, and skills to improve everyone's formative process, while simultaneously meeting individual needs through mutual commitment (Dione *et al*., 2010).

This concept is based on one of the essential characteristics of the human being, who is by nature fundamentally social, builder of communities and unifier (Orellana, 2005). Contact with others is crucial to acquiring new skills and abilities, and communication is essential to avoid isolation, learn, exchange, transform and transform others. Critical reflection and dialectical discussion in a community of learners allow the construction of knowledge through a constant search for meanings. The diversity and heterogeneous positions affirmed by dialogue enrich the construction of knowledge with a constant concern with the awareness of the other, all of which is ensured by mutual commitment (Orellana, 2015).

Considering the importance of social interaction and the collective construction of knowledge, the learning community becomes a powerful pedagogical tool, which allows the realization of shared activities around common goals. The main focus is to provide

adequate conditions for the development of skills, stimulating participation and dialogue among members (Cristol, 2017; Hamel *et al*., 2015; Lai; Law, 2006). From this perspective, the learning community is capable of producing changes in its members, creating professional, personal, cognitive, affective, and symbolic bonds that transform themselves and others (Orellana, 2015; Lerclec; Labelle, 2013).

The construction of a learning community is driven by rich work tools, such as discussion forums, exchange platforms and task management software, which enable the formation of networks of learners with the help of the Internet and communication and collaboration technologies (Laferrière *et al*., 2009; Pellerin; Allaire, 2010; Pellerin; Araújo-Oliveira, 2013). This approach allows students to explore and acquire a language related to their area of expertise, as well as to develop professional skills through meaningful interactions with other members of the community.

In addition, by working in a community of learners, students have the opportunity to experience authentic learning situations. According to Duval and Pagé (2013), this implies simulating situations that are as realistic as possible, or that resemble the daily life of the professional area studied. The proposed activities require students to perform tasks that go beyond the mere repetition or reproduction of memorization exercises. They present complex challenges that stimulate students' creativity and critical thinking, promoting exchanges and constructive discussions between them and the trainer, in addition to awakening engagement and motivation to learn.

This research groups seven frameworks formulated by the *International Scientific Committee on Communities of Learners and Knowledge building Communities* (ISCOL_KBC) (n.d.) into three distinct but interrelated perspectives:

1. The first perspective addresses the milestones related to the functioning of the learning community: a democratic functioning, where the usual power relations between trainer and trainee change dynamics; a cohesive but open community, where collaborative relationships are valued to the detriment of the spirit of competition among members, and an actively engaged trainer in their professional development, bringing a sense of professionalism to the community.
2. The second perspective concerns the framework of communication in the learning community, where a progressive dialogue is established when students share what they have learned, what they found difficult, and also when they provide *feedback* to each other.
3. Finally, the third perspective brings together the frameworks related to problem-solving in the learning community, including the approach of authentic problems,

which allow students to have access to an investigation process that takes them beyond memorization and repetition of routine skills. It also includes common learning objectives, making it easier to direct individual efforts to understand the object studied, and the diversity of individual knowledge and skills, which allow students to articulate multiple perspectives, solve problems in different ways, and use each other's knowledge and strengths to arrive at a deeper understanding of what they are studying.

Functioning in a learning community is particularly suitable for the realization of a 3D production, as it allows participants to share their knowledge, skills, strengths and questions. This collaborative process provides collective learning, enabling participants to better understand the realities of the group and develop meaningful bonds (Orellana, 2005). In addition, by using different pedagogical strategies to promote exchange and participation, students are encouraged to advance their knowledge and skills, avoiding stagnation or isolation (Leclerc; Labelle, 2013).

METHODOLOGY

In this qualitatively-inspired research, we conducted an action research based on the work of Guay, Prud'homme, and Dolbec (2016). We worked with two groups of approximately twenty students enrolled in the discipline *Bases of 3D creation* of the Bachelor's Degree in Media Creation offered by a French-speaking university in Quebec, under the supervision of the first author of this article, who is in charge of the course (hereinafter referred to as "the trainer"). The discipline *Bases of 3D creation* is an introduction to 3D production for artists who work in areas such as cinema, web, video games and cartoons. As the final project of the course is the production of a 3D short film in a team, it presents itself as an ideal environment for experimentation of a learning community, aiming at the development of professional skills related to 3D production.

The implementation of the community of learners was based on Laferrière's research on learning communities assisted by networked digital tools, carried out with high school students (Laferrière, 1999, 2008; Laferrière *et al*. 2009). To favor an interaction conducive to the development of the students, the trainer organized and directed the class in a precise way, establishing rules and procedures from the beginning of the project. Trainer and students worked together to transform the class into a community of learners, following the seven milestones presented in the conceptual framework. Through action and the achievement of common goals, the group operated in an interactive way. As Wenger (1998)

points out, students are able to gradually acquire specific notions of their professional field and the mastery of actions ranging from the simplest to the most complex when working in a community of learners. Both the trainer and the students were familiar with the use of digital tools and applications, which made their use much easier. The students of the Bachelor of Media Creation who participated in the action research are used to learning and handling digital technologies, which allowed them to maintain virtual contact after each meeting using these tools.

In the course, students were challenged to produce a 3D animated film in a team with a minimum duration of 30 seconds, following all the stages of the 3D production flow presented at the beginning of the article: development, pre-production, production and post-production. In addition, the entire project should be carried out in a learning community, respecting the seven milestones that sustain the concept of learning community, which were grouped into three perspectives presented in the conceptual framework: 1) Functioning in a learning community (democratic functioning, cohesive but open community, and actively engaged trainer); 2) Communication in a learning community (progressive dialogue); 3) Problem-solving in a learning community (authentic problems, common learning objectives, diversity of knowledge and skills). With this challenge, students had the opportunity to hone their technical skills and work as a team, while developing as active members of a learning community committed to progressive dialogue, authentic problem-solving, and joint learning.

After the end of the semester, a study was carried out through a group interview (Krueger; Casey, 2015) with ten students of the discipline (hereinafter referred to as "participants"), with the aim of reflecting on the lived experience. All participants voluntarily agreed and free of charge to contribute to this reflection phase. The interview was conducted by a research assistant who followed an established interview script based on the seven previously identified milestones. For data analysis, a procedure adapted from the works of Baribeau (2009, 2010) was adopted, which consisted of two phases. The first phase (preparation) was mainly dedicated to the appropriation of the content, preparation of the textual material, selection of the unit of analysis and preparation of the coding instruments. The second phase (analysis) consisted of coding, categorizing and describing the phenomenon studied.

In the next section, the main contributions and limitations of the implemented community of learners will be presented, according to the university students who participated in the project. To complement the presentation and illustrate the results

obtained, some textual passages were extracted from the interview and presented *in italics* and "between quotation marks".

RESULTS

Chart 1 below presents an overview of the results, highlighting the most significant elements observed in each of the aspects analyzed. These elements will be detailed later in this article.

Table 1 - Summary of the elements analysed

Prospect	Mark	Contributions	Limits
Operation	Democratic functioning	- Freedom of decision and action in the project. - Sharing important information and resources to progress.	- Problems accessing information (when not shared by students).
	Cohesive but open community	- Collaborative relationships valued rather than competition among students. - Community open to the world.	- *No limit identified.*
	Committed trainer	- Trainer introduces the sense of professionalism. - Trainer presents the multiple realities of the professional area. - Trainer is an essential reference/guide for the community.	- Concrete reality affected by the fact that there is no salary, but an academic grade. - The presence of the trainer can affect the autonomy and resourcefulness of the students.
Communication	Progressive dialogue	- The use of digital tools promotes dialogue and exchanges. - Opportunity to discuss ideas, lessons learned, and comprehension difficulties at all times. - Know where to go for help or advice.	- Lack of participation in the exchange of information from members can harm the community.
Troubleshooting	Authentic Problems	- A true research process that leads the student to go beyond memorization and repetition of routine skills. - In the face of real problems, students improve their resourcefulness, autonomy and sense of organization. - Members' positive personal investment in solving problems makes it possible to find resources to progress.	- Some members voluntarily depend on others to succeed or accomplish their task. - Members' negative personal investment in problem-solving can prevent them from finding resources to progress and develop their skills.
	Common learning objectives	- The object of study is clear to the entire community. - By sharing knowledge and skills, students contribute to making the subject studied accessible and understandable.	- *No limit identified.*

	Diversity of knowledge and skills	- The learning community puts its efforts into the specialization of its members. - Workload divided according to the strengths of each one. - Use of the knowledge and skills of each one to deepen the understanding of what is studied.	- Excessive specialization can hinder the development of other skills or the versatility of the professional.

Source: prepared by the authors

FUNCTIONING IN A LEARNING COMMUNITY

Democratic functioning

The first contribution identified is the freedom of decision and action of the students, which characterizes the democratic functioning of the project. Unlike other teaching formats, where decisions are made by the trainer, in this project, students have greater autonomy to decide what will be studied and how it will be carried out. Although there is a structure and restrictions inherent to the university context, students' freedom of decision and action resemble the practices of a professional studio, which prepares them for real situations in the job market. As one of the participants pointed out, "*this approach allowed students to take on more responsibilities and take initiatives in the development of the project, respecting the established guidelines*".

Each week, the teams had the obligation to inform colleagues about the progress of the different production phases through a specific blog for communication between the teams. This information allowed the group to identify new strategies for deepening knowledge and then share them with others. Everyone had access to community information, which made it easier to unlock tasks and progress faster. Sharing more detailed information, one of the participants stated that "*it was possible for the community to reach a higher level of knowledge*". This way of working made the process more efficient and facilitated the progress of all teams, allowing the community to move forward from a rich bank of easily accessible information.

The second contribution refers to the sharing of information and resources for the progress of all. Throughout the process, the trainer helped the students to find important resources to advance in the realization of the project. It has made available various digital tools (blog, forum, task management software, etc.). However, it is important to note that the discussion forum allowed students to discover for themselves important resources to advance their projects. By sharing links to web tutorials, texture banks, or 3D models, for example, the different teams contributed to the enrichment of the community's knowledge bank and resources. The trainer also occasionally posted various resources on this platform. For one of the participants interviewed, "*whether it was on the class blog or in the*

discussion forum, we all had the freedom to publish resources that allowed the entire community to progress."

While the learning community has been successful in sharing information and resources, there has been a limitation regarding the systematicity of this sharing. Although the trainer made digital tools available and the students collaborated with each other, valuable information was not always shared in the discussion forum, which compromised the enrichment of the community's information bank. Although it is possible to exchange information in the classroom, the lack of greater systematization hindered the access of some teams to important resources for the project. To avoid this gap, it would be important to stimulate the culture of sharing among students and highlight the importance of this exchange for collective progress.

Cohesive but open community

The first characteristic related to the cohesive but open community framework was the valorization of collaborative relationships to the detriment of competition among students, both within each team and in the entire class. There was no need to hide information or be discreet in the progress of the project, and students were encouraged to share their progress weekly on the class blog. In addition, they contributed to enriching the discussion forum information bank by asking questions, answering others, and providing links to tutorials or 3D resources. During classes, they also shared their information in brief presentations on the evolution of the work. According to one of the participants, "*despite the impression of competition and the feeling that the quality of our work was superior to that of the other teams, we realized that we could improve many aspects of our own work."* Collaborative work did not represent any limit to the development of professional skills, on the contrary, it was a real contribution to the community at all times.

The learning community was made up of two classes of students, each divided into four teams. One of the main characteristics of the community was the value given to collaboration to the detriment of competition among students, which favored positive and respectful communication among them, even outside the classroom, through digital tools made available to facilitate the presentation of projects and the exchange of opinions among colleagues. In addition, the community was open to the world, allowing the participation of external people and obtaining financial support for student projects, just like on the *kickstarter.com* website. However, a limitation was identified in the display of the class's blog posts only to the community, which made it impossible to widely

disseminate the works. Despite this, as one of the participants reported, "*there were still other platforms available for the dissemination of the projects*".

Actively engaged trainer

Based on the data collected, three important contributions of the actively engaged formative framework were identified. The first is that the trainer introduces a sense of professionalism into the community by sharing their experience and knowledge about the professional world and its various requirements. The second contribution is the simulation of specific situations in the professional field in the classroom, providing students with a structure and organization similar to the productive realities of the labor market, with short deadlines for the delivery of project stages. Finally, the third contribution is that the trainer is an important reference and guide for the community of learners, providing guidance and *feedback* for the development of professional skills. These contributions together have helped form a learning community more committed to developing professional skills.

While the actively engaged formative framework made some positive contributions to the learning community, participants also identified two boundaries. The first limitation refers to the lack of financial incentives, since the students' motivation was not supported by the monetary aspect present in the professional environment. One of the participants suggested that "*students were rewarded only with academic grades in the form of salary*," which could have affected their motivation. The second limit mentioned by the participants was the constant presence of the trainer. Although the experience and guidance of the trainer were useful, his constant presence in some situations limited the autonomy and resourcefulness of the students.

COMMUNICATION IN THE LEARNING COMMUNITY

Progressive dialogue

Participants highlighted three contributions related to the progressive dialogue framework. The first of these refers to the use of digital tools that promote and facilitate the exchange of information between community members. As one of the participants mentioned, "*the class blog, discussion forum, and other tools such as Facebook, YouTube, and emails make it much easier for community members to share information and contribute to the development of other members*' skills." The second contribution is related to the possibility of discussing ideas, sharing learning, and seeking help at any time, inside and outside the classroom. Students had the opportunity to get help from other community members to progress their projects. Finally, the third contribution is the ease of knowing

where to look for help or advice, thanks to the cohesion and unity among the members of the community. One of the participants highlighted: "*the members of the community are very close, spend a lot of time together and share a lot of information. With this, it was easy to seek help or advice from other members of the community*."

While most community members made an effort to share information on the blog, forum, and other digital platforms, some did not actively participate in the exchange of information. Some students preferred to keep certain information confidential or simply claimed that they had nothing to say about the subject. According to one of the participants, some found it unnecessary to post information because they could get the same information elsewhere. In addition, some members saw no interest in using digital tools and felt compelled to use them. This has limited the effectiveness of the progressive dialogue framework in the learning community.

PROBLEM-SOLVING IN A LEARNING COMMUNITY

Authentic problems

Authentic problems allow students to carry out a real research process to find solutions (the first contribution identified in relation to the authentic problem framework). This approach goes beyond simply memorizing and repeating routine skills. The second contribution related to this milestone is that, in the face of real problems, students expand their resourcefulness, autonomy and sense of organization. They don't hesitate to use new digital tools, ask for help from other community members, or look for the solution to problems on their own. The last contribution highlighted concerns the investment of members in the community. The positive personal investment of members is translated by the time they dedicate to the project, the effort they put into their work, and the positive energy they share with their team. In this case, this investment allowed, according to several participants, to find solutions to move forward with the common project.

However, some participants also perceived this aspect as a limitation. On some occasions, the excessive personal investment of some members seems to have "erased" the investment of others, even becoming harmful to the group. On the other hand, members who do not dedicate themselves enough can hinder the proper functioning of the team, which seems to have occurred with some participants. Another limitation mentioned by participants regarding this milestone is the fact that some members intentionally depend on others to succeed or to complete their tasks. As one of the participants suggested, "*They depend so much on others that they are prevented from developing their skills more autonomously.*" Finally, the last limitation related to this milestone refers to the

negative personal investment of the members in solving the problems, which made it difficult to find solutions to progress. During the interview, one of the participants made an interesting comment about the investment that a student can make in a project. According to him, "*the investment within a group is proportional to the respect one has for the other members of the group".*

Common learning objectives

The common *learning goals* framework is critical to the success of the learning community. First of all, having a clear object of study shared by all team members is crucial to facilitate the understanding and development of students' skills. As one of the interviewees stated, "*by sharing a common vision of the object of study, we develop similar skills and can share them more easily*." Secondly, gathering knowledge and skills from students helps to make the subject studied more accessible and understandable for everyone. No limits have been identified in relation to this milestone.

Diversity of knowledge and skills

Two important contributions are related to the diversity of knowledge and skills framework. Firstly, as highlighted by the data collected, specialization allows tasks to be distributed more precisely, reducing external interference and optimizing project realization. In addition, by separating the workload according to the individual strengths and particular interests of the participants, community members were able to better exploit each other's talents, knowledge, and skills, deepening their understanding of the subject studied. It is important to note that this separation of tasks must be done in a balanced way, ensuring that all members have opportunities for learning and development.

Although specialization has been an important contribution to the efficient distribution of tasks and deepening of knowledge in specific areas, it has also been identified as a limitation to the versatility of professionals and the development of other skills. As one participant pointed out, "*sometimes we put so much effort into a single area that we end up neglecting other areas or even all others*." Additionally, some members focused solely on their specialties, leaving other project tasks neglected and overwhelming other team members. As a result, some members felt abandoned by the "experts" and had to deal with a significant workload.

DISCUSSION

In the discipline *Foundations of 3D Creation* of the Bachelor's Degree in Media Creation at a French-speaking university in Quebec, we implemented a learning community that sought to mirror the professional realities faced during the realization of 3D projects in a professional studio. This approach is in line with Wenger's theory (1998), which emphasizes learning as a social phenomenon that reflects the human nature inherent in the search for knowledge. Consequently, the course focused on fostering collaboration among students, emphasizing the importance of a collective approach to problem-solving and project creation.

Based on the idea that the construction of knowledge occurs through the interactions between individuals and the belief that education is intrinsically linked to a social perspective, it is possible to invoke the vision of the learning community, defended by Bielaczyc and Collins (1999) and Orellana (2005, 2015), who state that a culture of learning arises when everyone is engaged in a collective effort of mutual understanding. According to the latter author, this type of community offers the hope of counterbalancing the negative orientations of our societies, focused on consumption and individualism (Orellana, 2005). Although there are many possibilities for functioning and organization in a learning community, our approach was quite specific to the realization of 3D projects. Thus, despite having been largely inspired by the work of the ISCOL_KBC committee (n.d.), we sought to adapt it to the current realities of 3D production and the complexity of the profession (Gagnon, 2018).

The first perspective of this research, which focuses on the functioning of the learning community, has similar contributions and limits to those of other professional learning communities. Previous studies, such as those by Dufour and Eaker (1998), Roy and Hord (2006), Dione *et al*. (2010), Leclerc and Labelle (2013), Raby *et al*. (2022), emphasize the important improvements in pedagogical practices with the implementation of professional learning communities. The implementation of the learning community in 3D production also shows similarities with other communities of specific interest, as described by Rheingold (1993) and documented in recent work, such as Raby et al. (2022), Peters and Savoie-Zajc (2013), Dionne and Couture (2013), and Hamel, Turcotte and Laferrière (2013). In addition, active and diversified pedagogical strategies are influential in both physical and virtual environments, as pointed out by Tremblay-Wragg (2018) and Araújo-Oliveira and Tremblay-Wragg (2022).

Although it was not the main objective of this research to study or compare all the modes of functioning of the community, it was possible to perceive the different links that

inspire its functioning. The three fundamental dimensions of the community of practice, conceptualized by Wenger (2005) as mutual commitment, common enterprise and shared repertoire of resources, are clearly present in the contributions of the first perspective of this research. In this sense, Laferrière (1999) would probably have been surprised to see his work initially carried out in partnership with primary and secondary schools (e.g., Hamel *et al*. 2013; Gregoire; Laferrière, 1998; Laferrière, 2008; Laferrière *et al*., 2009) adapted to university education, since it has its own specificities and distinct pedagogical needs.

The results regarding the contributions and limitations related to communication in a learning community highlight the importance of digital technological tools in contemporary society and in professional training more specifically (Pellerin; Araújo-Oliveira, 2013). As noted by Laferrière *et al*. (2005), this type of communication can motivate and stimulate students' reflection, generating new ideas and questions. According to Šašinka *et al*. (2019), dialogic communication is an important element in collaborative learning in virtual environments. Dialogue allows students to confront different perspectives, reflect on their own ideas, and develop a shared understanding of the subject at hand. In addition, dialogue can lead to the achievement of common goals, since students can work together to achieve them as a group. In short, dialogue is a crucial tool in collaborative learning, both in the classroom and in virtual environments. This approach is shared by Orellana (2005), who emphasizes the importance of dialogue in building a collective learning community, in which participants can better understand the realities of the group and develop meaningful connections. It is essential, therefore, to know how to get help and guidance to optimize the time and effort invested in the project. However, it is important to highlight that limited participation in the dialogue and use of the various proposed digital tools may prevent the enrichment of the common bank of information in a meaningful way.

The results related to the third perspective - problem solving - lead us to reflect on the importance of authentic and significant problems in the development of professional competencies. As highlighted by Haneberg *et al*. (2022), the use of authentic and meaningful problems in entrepreneurship educational programs for college students plays an important role in developing their professional competencies because it allows them to engage in practical activities that are relevant to their future careers. Authentic problems also help develop problem-solving, critical thinking, and collaboration skills, which are important skills in today's job market.

The search for new knowledge requires effort from the learner to understand the (dis)functioning of the world around him, although the level of engagement may vary among

community members. Unfortunately, as in any society, there are members who can harm the common project. As Wenger (1998, p. 86) points out,

> [...] In reality, the relationships between the participants represent complex combinations of power and dependence, joy and pain, competence and inability, success and failure, abundance and deprivation, authority and collegiality, resistance and conformity, anger and tenderness, attraction and repulsion, pleasure and boredom, trust and distrust, friendship and hatred.

The educational environment at the university is a unique opportunity for students to experiment and develop professional skills in a safe and controlled context. As in a professional production studio, the learning community is a valuable formative element, allowing students to practice working as a team and sharing knowledge. It is crucial that all members are clear about the object of study and the goals of the community. According to Laferrière *et al*. (2005), the clear definition of the object of study facilitates the direction of individual and collective efforts to carry out the project. From this definition, specialization becomes possible, allowing each member of the community to contribute with their specific skills and knowledge. It is important to highlight that valuing the diversity of knowledge and contributions of each one is an essential element for the success of the learning community.

CONCLUSION

Based on the results discussed above, it is possible to say that the creation of a learning community focused on the development of professional skills in 3D production is highly relevant. By working together, students are exposed to authentic learning situations, which reproduce the dynamics of the labor market and provide an experience closer to the professional reality that these students will encounter after training. According to Duval and Pagé (2013), community learning favors the construction of collective knowledge and enables students to develop valuable social and technical skills for their professional training.

It is also possible to say that the learning community presents itself as a promising path for the development of the skills necessary for the work of 3D production, since it provides authentic learning situations that reflect the demands of the professional field. However, it is important to note that the research had some limitations, such as its realization at a specific university and with a limited number of student classes, in addition to having been conducted in a region far from the main urban centers of 3D production. Despite these limitations, the action research carried out by the first author, who acted simultaneously as researcher and trainer, provided important evidence for understanding

the potential of the learning community in the development of professional competencies in 3D production.

Finally, we believe that it is possible to make university courses in 3D production even more formative and relevant for students. This type of device can be adapted to other related areas, such as digital production, traditional cinema, Web, design and programming. The learning community can also be applied to other areas with similar production procedures, such as technological design, computer science, numerical mechanics, and simulation. However, it is important to note that the field of 3D production evolves rapidly and research on the development of professional skills in this area is still scarce. Little data is currently available on the subject. Therefore, carrying out additional studies in the field of university pedagogy focused on 3D production is an important opportunity that should be explored to further improve the training of students. The integration of virtual and augmented reality technologies in the teaching of 3D production, the analysis of practices of integration of 3D production in disciplines in other areas, such as visual arts and architecture, and the realization of collaborative projects between universities and 3D production studios aimed at training students and developing their professional skills are some promising ideas.

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