

Beyond Gaming: The Potential of Twitch for Online Learning and Teaching

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ABSTRACT

Twitch is a live streaming platform that was originally designed for gamers to share their gaming experiences. The viewer culture on Twitch supports a lively exchange between streamers and viewers and also among viewers themselves. While the potential of Twitch for game tutorials and instructions has been explored, its potential for university lectures still appears to be undiscovered. In this paper, we discuss the potential of Twitch for teaching. We ran two different courses on Twitch, one for CS beginners, the other a game development course for students in a master's program. Evaluations with students show Twitch benefits, including increased engagement and interaction in chat and the ability to watch videos directly afterward. On the other hand, we also discovered several challenges, such as in-chat spam by bots. In this paper, we would like to discuss initial experiences from different perspectives and discuss best practices. Our aim in doing so, is to help other teachers decide whether Twitch might be a suitable online learning platform for their course.

CCS CONCEPTS

• **Applied computing** → **Education; Distance learning; Interactive learning environments; E-learning.**

KEYWORDS

Twitch, online learning, streaming, video education, live learning

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1 INTRODUCTION

The pandemic and the associated lockdowns have thrown many teaching concepts out of the window. Instead of interactive discussions with students in lecture halls, an abrupt and often unprepared switch to distance education has been the consequence. In addition

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to traditional e-learning tools accompanying the course and providing course content, different platforms and video and streaming tools have been used for delivering the lecture. One approach consists of pre-recording lectures. Video conferencing tools, such as Webex, Zoom, or MS Teams, on the other hand, allow the lecture to be delivered live to course participants in a closed environment and also to interact with students via video chat. Using these tools to maintain lively interaction even with larger groups can be challenging since it is hard to keep students engaged through the distance and to address them adequately. Additionally, lectures, usually held in a public lecture hall and allowing non-students to listen, lose their open nature. Public live streaming platforms offer another option. Tools such as YouTube or Twitch allow live streaming of lectures on a public platform and allow learners to consume the content in real-time without logging in. Twitch, a platform originally designed for the gaming community, is especially known for lively and rich interaction and information exchange between streamers and viewers via live chat. Twitch's interactive and social nature seems an ideal ground for interactive and engaging forms of online teaching, which also supports community building among students and therefore appears to solve other platforms' problems. Therefore, we (the authors of this paper) decided to use Twitch for two different courses in the computer science curriculum as a substitute for traditional lectures. In this paper, we evaluate and discuss the experience from the teachers' as well as learner's perspective to help other educators assess the platform's potential and challenges in the educational context.

For this reason, we formulated the following research objectives:

- Evaluate interaction possibilities on Twitch (both between lecturers and students as well as among students).
- Gain insight into the learner's perspective on Twitch as an online learning platform and into the way they use Twitch.
- Discuss strategies to avoid toxic behavior and spam on Twitch.
- Identify advantages, disadvantages, limitations, and potential issues of Twitch, thus helping other teachers decide whether Twitch might be a suitable platform for their course.

2 BACKGROUND AND RELATED WORK

In recent decades, many different development and research efforts have been conducted to improve and evaluate different techniques and tools for distance learning and teaching. In this chapter, we first discuss previous research and background about online live learning and conclude by discussing the live-streaming platform Twitch, previous research on Twitch, and its educational potential.

Online Live Learning. In contrast to a traditional face-to-face learning setting, an online learning approach is characterized by

the following features, according to [14]: (1) There is a (physical) distance between teachers and students. (2) Technology is used to access teaching content such as lecture videos or notes. (3) Technology is used for social interaction between students and teachers. (4) Additional support for learners is carried out using technology. Online learning can be both synchronous and asynchronous. Synchronous online learning is defined by real-time interactions and immediate feedback. Common forms are live video-conferences, lecture streams, or chatting. Asynchronous learning is highly self-guided and self-paced. Students have access to pre-recorded video content and lecture notes [5]. Most implementations of online learning around the turn of the millennium were restricted to asynchronous forms of education (e.g. [15]). Since then, the focus has increasingly shifted to live online learning. Already 15 years ago, [7] listed many opportunities online live learning can offer. Among these are "real-time polling, drawing, annotation, [and] text chat". Despite the advantages of online learning such as high flexibility, interactivity, and self-pacing, high-quality online education requires detailed planning, a suitable curriculum, and digital competence of learners and educators [1]. The convenience of live online learning is a major advantage, but the communication between students and teachers is suffering in many cases. A primary concern related to online learning is the absence of face-to-face communication [8]. Various tools and approaches aim to overcome this hurdle by increasing interaction, for instance via quizzes, live Q&A, polls, or chats, thus engaging students and providing feedback.

In recent years, more educators have also turned to public platforms such as YouTube Live to distribute learning content [4, 9].

Live Streaming Platform Twitch. *Twitch.tv*¹ is a video live streaming service with a focus on video game live streams. It has continuously gained popularity over the past years and became one of the largest Internet traffic sources. As of January 2021, SimilarWeb² lists Twitch on their 42nd rank with 1.08 billion total visits between June 2020 and December 2020. Twitch is mainly known and designed for game streaming. As a consequence, previous research on Twitch primarily concentrates on this use case [11]. The atmosphere of Twitch can be described as communicative, interactive, social, and engaging. Many streamers encourage their viewers to communicate with them via Twitch's integrated chat. Communication among viewers is another defining feature of many streams. As a result, Twitch is not only a place to watch others play. It is an online space to meet and build communities. Already in 2014, Hamilton et al. [10] describe Twitch as a place where informal participatory communities emerge, where viewers meet to socialize and participate. That viewers on Twitch are not there only to watch but also want to join in has also been shown by Diwanhi et al. [6]. They conclude that Twitch viewers enjoy reacting to information and producing their own information. The live streams are treated as a community space, and co-presence is a crucial element. This already suggests that Twitch's nature is different compared to traditional online lecturing and video communication tools. As a communicative space, where learners want to share information, Twitch streams appear to be an exciting place for educational content. Therefore, it is not surprising that Twitch is often used for

learning. Viewers often observe other streamers improving their gameplay or watch various tutorials. While the former is an inherent element of Twitch, we are interested in the latter for this article. Developers are increasingly using Twitch as a platform to share knowledge, code live, or host tutorials for free.

Johnson and Woodstock [12] discuss the potential impact of such efforts with a focus on game development. Traditional game development courses are often costly, and the games industry is known as a challenging place to get into. Additionally, the games industry often struggles with the inclusion of minorities. Open educational efforts on Twitch are opening up new possibilities for future game developers all around the world to learn for free in "coding streams" (game developers live coding in their games) and ask the developers questions. Thus, the authors argue that Twitch can be the beginning of democratizing access to the games industry. The potential of "coding streams" – also for CSE – has been explored by Haaranen [9]. They underline the possibility of such streams to reach wider audiences and spark their interest in programming. Payne et al. [13] evaluate Twitch's potential as a learning platform with a focus on video game tutorials and amateur online instructions. They demonstrate with a laboratory experiment involving 350 participants Twitch's efficacy as a learning platform and found that learning under novice instructors was at least as good as that of experts. Brown [2] mentions four unexpected outcomes when using Twitch in a university context: (1) students signing up for Brown's class or the university program because of Brown's streams, (2) professionals from the games industry joining the streams, (3) influencing others also to start streaming, but also (4) concern over harassment, due to Twitch's reputation of toxic gamer culture.

Thus, we can conclude that Twitch is not just a streaming platform; it can also be described as a participatory space that enables community building, information sharing, and social interactions. Its popularity can be leveraged to bring content (and interest in this content) to a wide audience. The unique nature of Twitch motivated us to move our CS courses to this platform and evaluate the potential for computer science education by exploring potential positive features (e.g., interactions, community) and challenges (e.g., toxicity, spam). We will discuss these details in the next sections.

3 TWITCH FOR CS EDUCATION

The lockdown forced us to find online solutions for our courses (Game Development (GD) and Programming 101 (P101)), which were originally designed highly interactive. Therefore, the goals of the redesigned online format were to: (1) support interactions and discussions between learners and teachers, (2) encourage learners to actively participate during lectures, (3) give learners the possibility for self-assessment and immediate feedback, (4) provide enough room for organizational questions for the practicals and the exam, (5) while maintaining the public and open character of these lectures. Inspired by the interactive and communicative character of Twitch sessions, we designed our lectures to be broadcasted on Twitch.

3.1 Setting

Game Development (GD) Lecture. The game development lecture is a course for students who already have a bachelor's degree in

¹<https://www.twitch.tv/>

²<https://www.similarweb.com/website/twitch.tv/>

computer science and are in the master's program for CS and CS-related studies. It is split into two parts and employs a traditional lecture format, designed around several in-class discussions and polls. The second part is a practical exercise where students have to work on a game project. Twitch was used for the weekly 60-minute long theoretical lecture, and we organized group communications and tutoring sessions via Discord³. We used questions for students to discuss in the chat as well as polls as interaction methods. The course was open, and no viewer or chat restrictions were in place. On average, two moderators attended the lecture and overlooked the chat to moderate and stop inappropriate comments and bots. After the lecture a Q&A session was held over a voice channel limited to students of the lecture on Discord. We looked at the lecture statistics for the period from October 18 to November 16 to gain a better understanding of the lecture viewer counts. Four lectures were given during this period with 1,455 unique viewers watching the stream, while 136 unique chatters were identified. A total of 1,457 chat messages were recorded (see Table 1).

Programming 101 (P101) Lecture. The programming 101 lecture is a first semester course in the bachelor's program for CS and CS-related studies. The lecture follows a *flipped classroom* approach, where students are given access to course content (videos, slides, code) at the beginning of each week. Using these materials, the students are expected to prepare for the synchronous online course, two 45 minutes streams via Twitch. The first stream focuses mainly on the materials provided at the beginning of the week, revising and elaborating on topics that were introduced in the provided contents. Furthermore, the lecturers answer questions related to these topics. The Twitch chat is used as the primary tool for interacting with the students, answering questions, and providing further information and resources. For higher interaction and immediate feedback, a poll functionality (more precisely Straw Poll⁴) is used to ask topic-related questions. The second part of the stream covers practical and organizational topics related to the programming assignments. Besides the Twitch chat, the audience response tool Mentimeter⁵ is used to systematically receive and answer questions. Both parts of the stream are held by two lecturers and at least two moderators. From October 18 - November 16, four lectures were streamed, with 1,332 unique viewers watching. In total, 200 unique chatters were identified, sending 2,413 messages in the chat.

3.2 Material and Methods

To evaluate Twitch as a teaching tool, we sent out a survey to the students from the GD and P101 classes. The research scope of this survey has been defined broadly: Evaluate (1) advantages, (2) disadvantages, (3) experiences compared to traditional lectures, (4) experiences with the interaction format, and (5) discuss ideas for improvement. Out of 113 students of the GD class, 25 filled out the survey, 13 completed all questions. The students are between 20 and 33 years old, the average age being 25.26 (SD=3.4). 72% of the students are male, 20% female. They started to study between 2010 and 2020, with an average year of 2015.22 (SD=2.3). Out of 820 students enrolled in the P101 class, 269 attended the survey, 132

Table 1: Overview of the Game Development and the Programming 101 class.

	GD	P101
Course Content	Game Design	Programming
Study Program	Master's CS	Bachelor's CS
Registered Students	113	820
Survey participants	25 (22.12%)	269 (32.80%)
Fully completed questionnaires	13 (11.50%)	132 (16.10 %)
Average Age	25.26 (SD=3.4)	21.63 (SD=3.8)
Avg. Enrollment Year	2015.22 (SD=2.3)	2020 (SD=3.8)
Unique Viewers (4 lectures)	1,455	1,332
Unique Chatters (4 lectures)	136	200
Chat Messages (4 lectures)	1,457	2,413

completed all questions. Their age ranges from 17 to 42, with an average age of 21.63 (SD=3.8). 80.90% of the students are male, and 18.18 % are female. The majority of these students (78.54 %) started to study in 2020. The participants filled out the questionnaires anonymously. We asked open questions as well as questions on a Likert scale between 1 (strongly disagree) and 5 (fully agree). We also use answers from incomplete questionnaires, as these also included essential comments in the open question sections.

4 FINDINGS

The general opinion about Twitch expressed by students was mainly very positive and several of them mentioned that they preferred the presented format on Twitch over other lecture formats held on platforms such as Webex or BBB. In the following, we describe the survey results in more detail from the perspective of the students.

Advantages

Our students listed the following advantages in the open question sections.

Encouragement to participate. The students stated that the interactive nature of Twitch motivated them to write more in the chat than in traditional video streaming tools or during traditional lectures. In a traditional lecture, often there is not enough time or students are too shy to ask questions. Twitch alleviates the latter issue through its atmosphere which is perceived as being more casual compared to other online learning tools. Furthermore, viewers can stay anonymous if they wish to. This distinguishes Twitch from other online learning platforms, such as Webex or BBB.

Live, synchronous interactions. The interactive and live character of Twitch allows students to ask questions, even though the lecturer might still be talking.

Rewatchability. Twitch allows watching the streams (including the chat discussion) immediately after the stream for 14-60 days. This feature is valuable in case students were not able to attend the lecture live or should they want to rewatch parts they did not fully understand. (It also reduces the lecturer's effort to host the video.)

Usability. Twitch is very easy to use. Students can consume live streams from different devices, even without being registered. In

³<https://discord.com/>

⁴<https://www.strawpoll.me/>

⁵<https://www.mentimeter.com/>

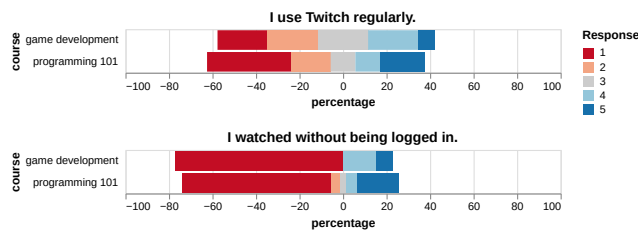


Figure 1: Usage-related responses on a Likert scale ranging from 1 (strong disagreement) to 5 (strong agreement).

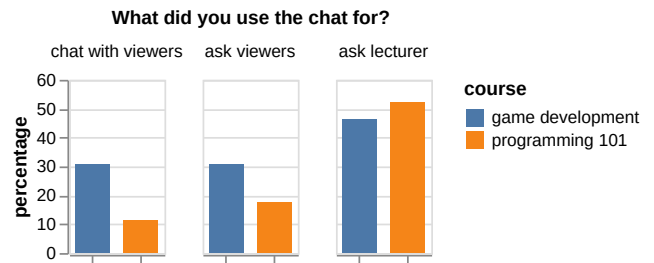


Figure 2: Use of Twitch's chat function.

contrast to some other tools, students do not need to perform microphone checks (as their audio is not recorded).

Polls. Twitch offers built-in (anonymous) polls – an important tool for interactions with a large class.

Open to everyone. As Twitch is an open platform, people who are not students can also participate and learn. This can lead to interesting discussions from other perspectives. Twitch is also open in the sense that no registration is required to watch a stream. However, as shown in Figure 1, most students did log in, which allows them to actively participate in the chat.

Known platform. As Figure 1 shows, many students already use Twitch regularly. This, together with the platform's increasing popularity, ensures that students are familiar with the tool.

Disadvantages

We also asked the students to describe the disadvantages in an open question format.

Not Personal. As it is an open stream and anonymized nicknames are used, and since students can only use a text chat, the stream often has a more impersonal atmosphere.

No Voice Channel. In contrast to tools such as Webex or BigBlue-Button, students cannot participate in the discussion through a voice channel on Twitch.

Connection Troubles. Live streams can experience connection troubles (students or lecturer).

Seriousness. The nature of Twitch is less "serious" compared to traditional lecturing platforms. Also, distractions such as raids, commercials, and bots add to this problem.

Distracting Chat. In streams with several hundred viewers, the chat can become distracting, and questions might get overlooked.

VOD limited. The VODs can only be rewatched for a specific time period (14 days, 60 days for Twitch "partner").

Open to everyone, Trolls. As Twitch is an open platform, people who are not students can also participate, which can lead to an impersonal atmosphere, inappropriate conversations, and drawing away the attention of course participants.

The Twitch Chat

Many students mentioned that they liked the interaction in the chat and were more engaged than in traditional setups or other lectures to chat with other students, discuss the content, and ask questions. As shown in Figure 3 and Table 2, the majority read the chat while also listening to the lecture, and many used the chat for interactions. As illustrated in Figure 2, in both lectures, students interacting in

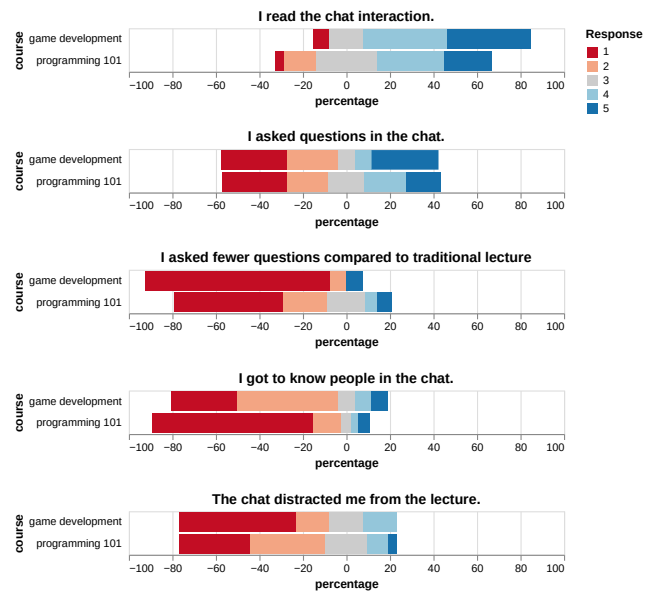


Figure 3: Chat-related responses on a Likert scale ranging from 1 (strong disagreement) to 5 (strong agreement).

the chat mostly used the chat to ask the lecturer questions. In the game development lecture, more students also used the chat to chat with other viewers or ask other viewers questions.

We also asked them if they were distracted by the chat from the lecture. Most students mentioned they were not at all distracted. Not a single student rated they were very distracted. In GD, the average mean was 1.92 (SD=1.19). In P101 the mean was 2.17 (SD=1.11). We were also interested in whether they got to know people in the chat. They rated the statement "I got to know people in the chat" in GD with 2.15 (SD=1.21) and 1.52 (SD=1.08) for P101. While most students did not get to know other people in the chat, some had the experience of connecting socially. It is interesting to note that in the class with fewer students (and fewer viewers on Twitch), the data seems to show that they were more likely to connect with others compared to the bigger class. All lecturers had the impression that more questions were asked compared to traditional lectures. We also asked the students, if they felt that they ask fewer questions compared to traditional lectures and most of them disagreed with a mean of 1.38 (SD=1.12) in GD and 1.98 (SD=1.23) in P101.

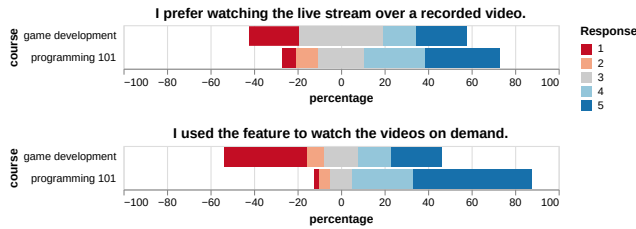


Figure 4: Video-related responses on a Likert scale ranging from 1 (strong disagreement) to 5 (strong agreement).

Table 2: Results on a Likert scale between 1 (strong disagreement) and 5 (strong agreement). Means and standard deviations are reported for both courses.

Statement	GD M(SD)	P101 M(SD)
I prefer watching the live stream over a recorded video.	3.15(1.46)	3.73(1.22)
The chat distracted me from the lecture.	1.92(1.19)	2.17(1.11)
I got to know other people in the chat.	2.15(1.21)	1.52(1.08)
I asked questions in the chat.	2.85(1.72)	2.73(1.46)
I read the chat interaction.	4.00(1.15)	3.52(1.12)
I use Twitch regularly.	2.69(1.32)	2.57(1.58)
I used the feature to watch the videos on demand.	2.77(1.69)	4.27(1.00)
I asked fewer questions compared to traditional lectures.	1.38(1.12)	1.98(1.23)
I watched without being logged in.	1.77(1.48)	2.02(1.63)

Experience compared to Recorded Lectures

Figure 4 gives an overview of the video-related answers the students provided on a Likert scale. When we asked students about their experience with the Twitch lectures compared to recorded lectures, they mentioned that they liked the interactive communication between the lecturer and the students and other students. The students mentioned that they liked recordings because this function allows them to pause without missing what is going on at the moment (e.g., chat interactions). The possibility of increasing the playback speed is also an appreciated feature of videos. On Twitch, the time to rewatch lectures is limited to 14-60 days. This is why students mentioned they would prefer that the videos are also uploaded to a different platform. From Figure 4 we see that VODs are used especially in the programming course.

Experience compared to Traditional Lectures

Students noted both advantages and disadvantages when comparing this format with traditional lectures. It often felt easier to ask questions and interact with the lecturer. This is also consistent with the third panel of Figure 3. They also saw benefits in being able to (re)watch the lecture from home and on different devices. Many students, however, mentioned missing social interactions and contact with their colleagues. They also mentioned, being more likely to become distracted than in the lecture hall.

Experiencing Interactions

The main channel for interaction between viewers among each other and between viewers and streamers is the Twitch chat. The majority of the viewers read the interactions in the chat regularly. Many viewers answered that they enjoyed this form of interaction since they could ask questions anonymously and receive an immediate response via chat or stream. Although in one of the two lectures, feedback⁶ and Mentimeter were used to reinforce interaction, the viewers asked for more quizzes. Nevertheless, some programming course students responded that they do not like the interaction in the chat and even that they simply watched VOD, because of getting distracted and irritated by toxicity, harassment, and spam. Due to the many chat messages, the streamers were not able to capture every question, but they tried to respond to important or repeating questions. As a consequence of the lockdown, the vast majority of the Programming 101 class students have never experienced traditional face-to-face interaction that takes place around the university. This made it hard for them to get in touch with other students and to socialize. This group of students in particular responds that they wish more direct communication.

5 DISCUSSION

In this paper, we have presented what has been learned from teaching with Twitch. Twitch is defined as a live-streaming video platform. Various interaction features, such as a chat or live polls make it an interactive tool. The option that videos are available to rewatch after the lecture as VOD (video on demand) is already integrated. Streamers can communicate directly with the audience and respond to questions in the chat. The people in the audience can communicate with each other and answer each other’s questions. In previous research [6, 10], Twitch has been shown as a tool in which viewers meet not only to observe but to participate, build communities, and not only to absorb information but also to react and add to it. This makes Twitch an ideal platform for educational content, and many streamers are already using it for live coding or organizing tutorials [9, 12]. Nevertheless, research of the potential of Twitch for education is still limited and to our knowledge, no research on the use of Twitch for CSE has yet been presented. This paper presented the experiences from two different lectures with more than 100 students per class – a programming 101 course for first-year students and a game development course for students in the master’s program. The results show us the great potential of Twitch, as students like to use the interaction possibilities to ask additional questions. There also seem to be more questions asked than in a traditional lecture, which would be an interesting question for future work to verify. Viewers also appeared to use the tool for building social connections, especially in the smaller lecture.

Educational Purpose. Our two lectures differed in their educational goal and the group of viewers. The game development class addresses mainly CS master students with the goal to develop a video game. Programming 101 is a bachelor course with several programming assignments and a final exam. As a consequence of the university lockdown, the live streams are a crucial element in direct communication. When comparing the chat conversations of both streams, the programming 101 chat was used more widely

⁶<https://feedbackr.io/>

for organizational questions primarily related to assignments and the exam. The game programming course is designed for rich discussions between students and the lecturer. In this case, it was a valuable addition that viewers not related to the course (for example, interested parties from the gaming industry) were in the chat and answered questions from other perspectives.

Experiencing Toxicity, Harassment, and Spam. Twitch is not only known as a social and interactive space, but unfortunately also for potential issues with toxicity, harassment, and spam. Cai and Won [3] explored effective strategies described by streamers to combat toxicity. Among other, locking (banning or timing-out toxic persons) and educating (e.g., explaining to toxic persons how to act appropriately, explain rules of the stream) were described as the most effective strategies. We also employed these strategies in our streams. Both courses were supported by moderators who immediately removed inappropriate comments. The increased need for moderators can be considered as one disadvantage of Twitch. Besides enlisting moderators, we explained a clear code of conduct and rules in the stream description, and viewers had to confirm these before entering the chat. Besides organizational information, the stream rules have been added as a custom command in the stream chat. Moderators and viewers used this command to respond to messages that violate the code of conduct. Also, chatbots such as Nightbot⁷ proved to prevent toxic messages following a specific pattern or including offensive terms from a blacklist.

VOD usage. Interestingly, Figure 4 shows that VOD usage differs considerably between our two courses. Compared to the game development course, VODs would appear to be much more important for the 101 programming students. We assume that this is a consequence of the differing examination modes in the two courses. Game development lacks a formal examination, and we think that the prospect of an exam is a significant incentive for our students in the 101 programming course to rewatch the lectures. Depending on the examination mode, the VOD function will be more or less important for lecturers who decide to adopt Twitch for their course.

Level of Formality. Twitch is perceived as less formal than other online learning platforms. This can be either a disadvantage or an advantage. Some students reported that they missed a more formal setting, while others enjoyed the more casual character of Twitch. The latter group reported that they experienced the lectures as being more personal, and they thus felt more motivated. Furthermore, the Twitch live-coding sessions showed our students that even experienced programmers could make mistakes, which some students said was an encouraging discovery for them. The level of formality must be considered when deciding on adopting Twitch for a university course. Teachers should aim for a high congruence between their teaching style and the formality level of the tools used. Furthermore, the audience must be taken into account during the decision process. We think that CS-related courses in particular might be suitable candidates for switching to Twitch.

Extensions. A promising feature of Twitch (which has not yet been used much for the courses presented) is the possibility to install extensions or for self-implementation these. This includes, for instance, chatbots answering typical questions, minigames, or integrated high scores. This makes Twitch a very flexible platform

supporting the implementation of different engaging elements and teaching methods.

Recommendation. Despite the listed challenges that come with Twitch as an online learning platform, our experience was mainly positive and the majority of our students reported that they were very satisfied with this solution. Twitch features, such as anonymity and openness, make it stand out from more traditional online learning platforms and while we do not recommend Twitch for every possible course, we believe that these features would prove beneficial for many courses.

Limitations and Future Work. We wish to point out that not all of the students participated in our survey. It is thus not clear whether the positive attitude of the participants towards Twitch is shared by the rest of our students. Nonetheless, our first attempts with Twitch have encouraged us to conduct further courses in the future including further studies on Twitch. We plan to further investigate the potential of Twitch as an online learning platform. One interesting research topic would be whether the view students have about Twitch and their interaction behavior will change over time. We also plan to include more courses in our analysis and to investigate whether Twitch has an impact on student performance. Another topic we are interested in concerns the demographic characteristics of learners and the possible implications of this on the choice of the online learning platform.

The primary objective of this work was to help teachers decide whether Twitch can be a suitable online learning platform for their lectures. Our findings are not solely based on our experience as streamers but also on the perspective of our students. When deciding on whether to move a lecture to Twitch, teachers must take their audience into account. We believe that this paper can help educators to assess the possibilities of Twitch for their lectures. While Twitch comes with many advantages, we especially want to also share the challenges we faced and also to conclude this work with recommendations on how we tackled these issues (see Tab. 3).

Table 3: Overview of challenges and recommendation

Challenge	Recommendation
Spam and Bots. Twitch is an open platform full of bots & spam.	(1) Use moderation (2) Use own chat bots
Interactions. Keep viewers engaged in the stream and encourage them to participate.	(1) Polls (2) Q&A directly after the lecture (3) Quizzes with additional tools
Technical Issues. Live streaming requires a well-working setup (audio, video, connection, etc.).	(1) Highly flexible streaming software (on-the-fly changes) (2) Pilot tests before streams (3) Stable internet connection (wired)
Stream Organization. Streams are part of lectures, which requires a structured procedure.	(1) Advance Planning (2) Provide stream agenda (+ schedule) (3) General structure for all streams

⁷<https://nightbot.tv/>

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