Comparison of 2D Virtual Learning Environments with Classic Video Conferencing Systems for Tertiary Education

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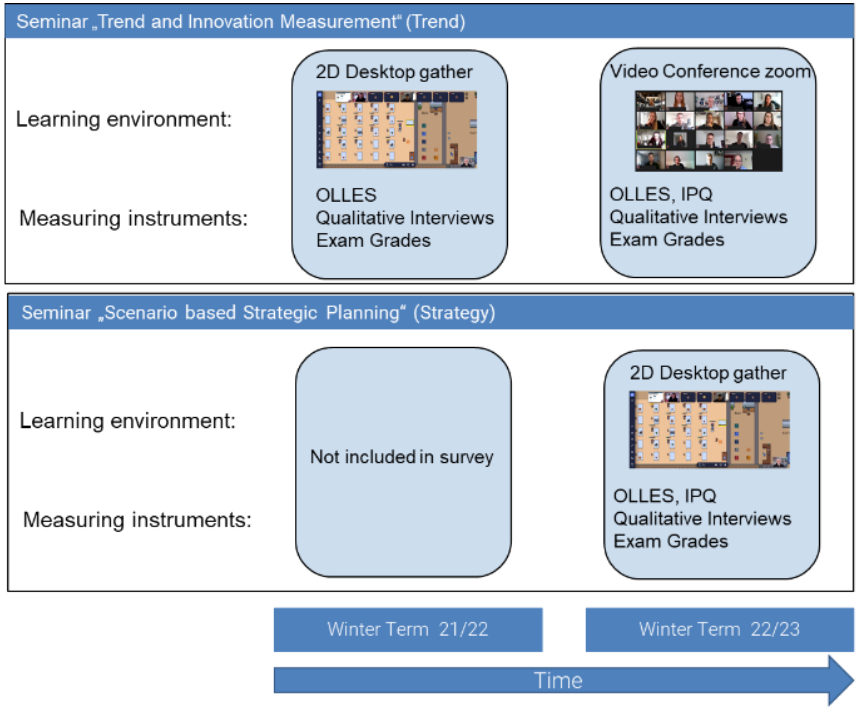
Prof. Dr.-Ing. Gerhard Hube

Professional and academic career

- Since April 2010 professor for “Strategic Innovation Management” and responsible for the Master Program of “Integrated Innovation Management”. Member of the committee for technology and research at the chamber of industry and commerce in Würzburg, director of digital business and future technology lab. Research on innovation management, future technologies and virtual learning environments&digitalization
- From 2006 to 2010 head of department “Market Intelligence & Future Technology" at Freudenberg company responsible for concept and implementation of the strategic innovation management in Europe.
- senior-scientist&consultant at Fraunhofer-IAO with the main focus in future technologies and knowledge management in an international context, doctoral thesis in 2005 about knowledge work and innovation management awarded with the Fraunhofer IAO innovations award
- product manager&consultant in an IT-startup enterprise until 2000
- diploma degree for industrial engineering in 1995

I. Introduction

- This contribution is based on the first step of the study published in June 2022 at the IARIA conference in Porto with the title “Suitability of Immersive 2D Environments for Tertiary Education using the Gather Environment as an Example” [1].
- Result was that an Immersive 2D Environment can be used holistically as a form of teaching and has advantages over Classic Video Tools
- Nevertheless, this first study only used immersive 2D environment Therefore, this is the goal for this research. Here, the same teaching unit is being tested again in gather.town and at the same time another teaching unit is being tested in Zoom.
- Besides OLLES [2], IPQ [3] and qualitative interviews as described in first publication [1] were used

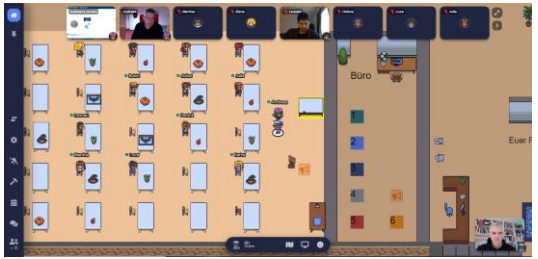


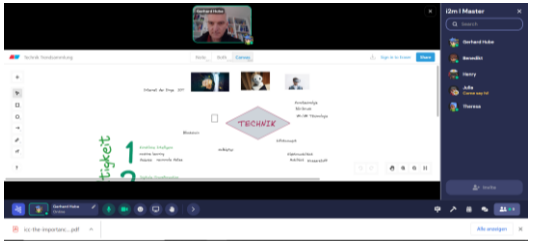
II. Related Work, Motivation

- Additional, to the literature review from our study in 2022 [1], there were several new studies published about educational online learning especially with Learning Management Systems (LMS) like Moodle and Video Conference Systems especially Zoom [4] [5] [6] [7] [8].
- In addition, many studies about the phenomenon of “Zoom fatigue” were published [9] [10] [11] [12] [13] which underlines the need for alternative online Learning Environments like low immersive Desktop Environments. Lo, [14] did a review of the empirical studies in gather.town and revealed that there is still a lack in studies besides computer science courses, the examination of student’s behavior and learning achievements.
- With this study, we evaluate Virtual Learning Environments over several semesters in the context of seminars not in computer science but in business administration. We also include exam grades for learning outcomes. With these conditions, we fulfill some of the requirements for further research by Lo [14].

III. Method gather.town

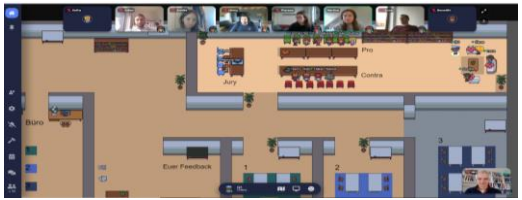
- The software gather.town [15] was used as an immersive 2D desktop environment. This is a web conferencing software that allows to create a complete virtual replica of the teaching building.
- Podium:
  The podium is the classic teaching situation. Within the gather.town environment, all students and the tutor are in one large room. The tutor stands in front at the lectern, while the students take their places at the tables.
- Whiteboard:
  The whiteboard provides an opportunity for collaborative work. To do this, the whiteboard must first be activated. After that, all users who access the whiteboard at the same time can work together on it. This means that all users get write permissions and can interact with the whiteboard.

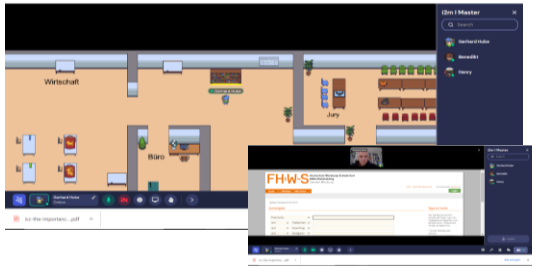




III. Method gather.town

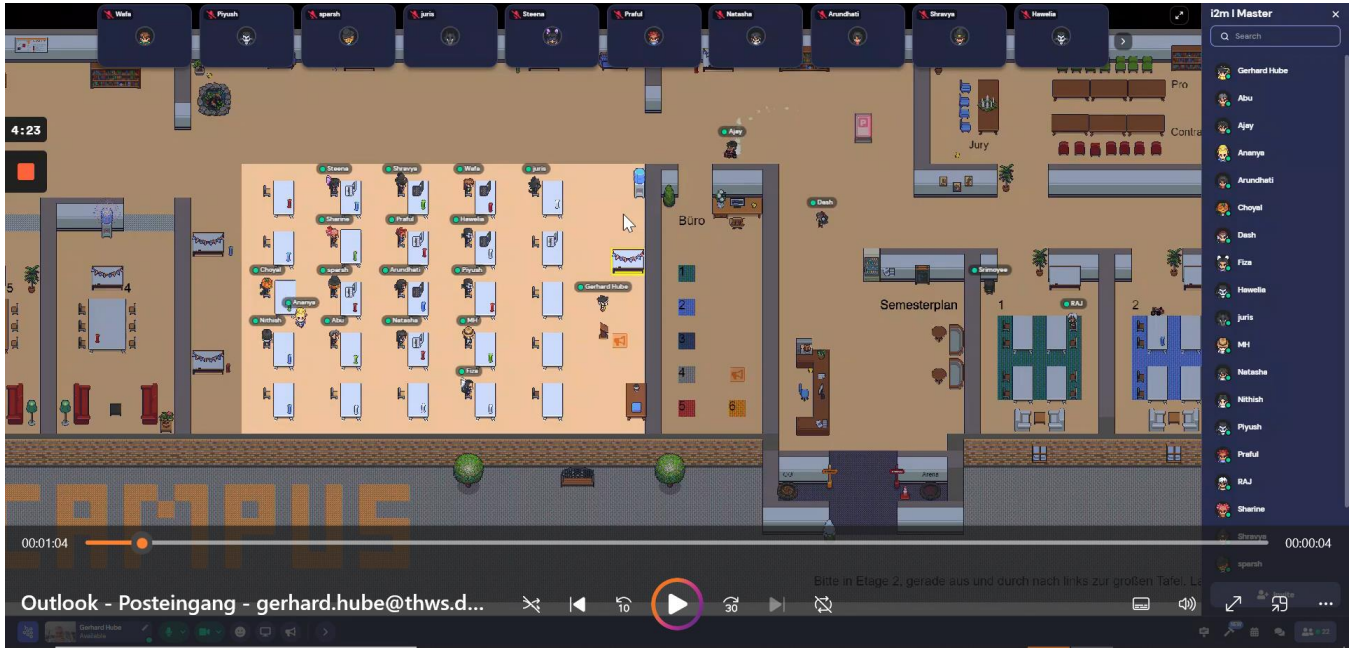
- Workshops:
  Workshops are smaller rooms that provide fewer seats than the large seminar rooms. Here, there are tables with seats and a whiteboard. Thus, the users have the possibility to do smaller group work.
- Group Discussion:
  This is a room that is designed in such a way that a pro and a con side can sit opposite each other and participate in a group discussion by means of the camera.
- Interactive objects:
  Within the environment, other interactive objects are stationed in the individual rooms or corridors. In the entrance area, for example, there is a blackboard on which the timetable can be viewed, and next door, there is a tutorial that once again describes the functionality of the gather.town environment in a video.





III. Method gather.town

- Breakout rooms and plenum at lecture with gather.town



III. Method Zoom Video Conferencing

- Zoom is one of the classic video conferencing tool with quite wide spread usage for education, especially while COVID-19 pandemic but also after reopening universities in 2021 [4] [16].
- With Zoom it is possible for one or more people to interact through chat messages, video based visual communication, and group work [17].
- Besides the communication in the whole group of participants, it is also possible to create subgroups (Break out rooms) for group work or group discussions. There is also the possibility to share the screen with other participants, to do little surveys and to use a whiteboard. The classic appearance is the monitor full of video tiles with the participants of the zoom meeting

IV. Measuring Instruments

1. ONLINE LEARNING ENVIRONMENT SURVEY (OLLES) Questionnaire [1]
   Web-based survey instrument, used in online learning environments in tertiary education, 7 Dimensions, 5-point Likert scale, Student Collaboration (SC), Computer Competence (CC), Active Learning (AL), Tutor Support (TS), Information Design and Appeal (IDA), Material Environment (ME), Reflective Thinking (RT)
2. IGROUP PRESENCE QUESTIONAIRE (IPQ)[3]
   The IPQ has three subscales and one additional general item not belonging to a subcale. The three subscales are Spatial Presence (the sense of being physically present in the VE), Involvement (measuring the attention devoted to the VE and the involvement experienced) and Experienced Realism (measuring the subjective experience of realism in the VE). There is also a general item that assesses the general “sense of being there”. This item has high loadings on all three factors, with an especially strong loading on Spatial Presence
3. Qualitative interviews [1]
   After checking remembering of lectures, at least one question was asked about each dimension of the OLLES to develop a deeper understanding of why one of the dimensions had performed well or poorly. It was also investigated whether the subjects prefer face-to-face classes, a virtual learning environment such as gather.town or classic video conferencing like Zoom and why

V. Procedure & Sample

- Experimental Procedure
  - Introduction to gather.town and zoom environment, testing of basic functions,
  - Introduction to OLLES questionnaire (used in original English language)
  - Both seminars were held over 5 days each
  - 2 measurement time points, after first seminar and after the last seminar
  - Qualitative interviews were collected a few days after the last seminar conducted within the VLE gather.town resp. zoom
- Sample
  - 16 valid subjects, only students from the Technical University of Applied Sciences Würzburg-Schweinfurt within the seminars “trend analysis and innovation assessment” (Trend) and “Scenario Based Strategic Planning” (Strategy) of the master study program “Integrated Innovation Management”
  - Average age of 25.19 years, with a minimum of 22 years and a maximum of 33 years.
  - Of the n = 16 subjects, 5 are female (31.3 %) and 11 are male (68,7 %)
  - comparison of two measurement points, only 11 subjects with completely questionnaires.

VI. Results

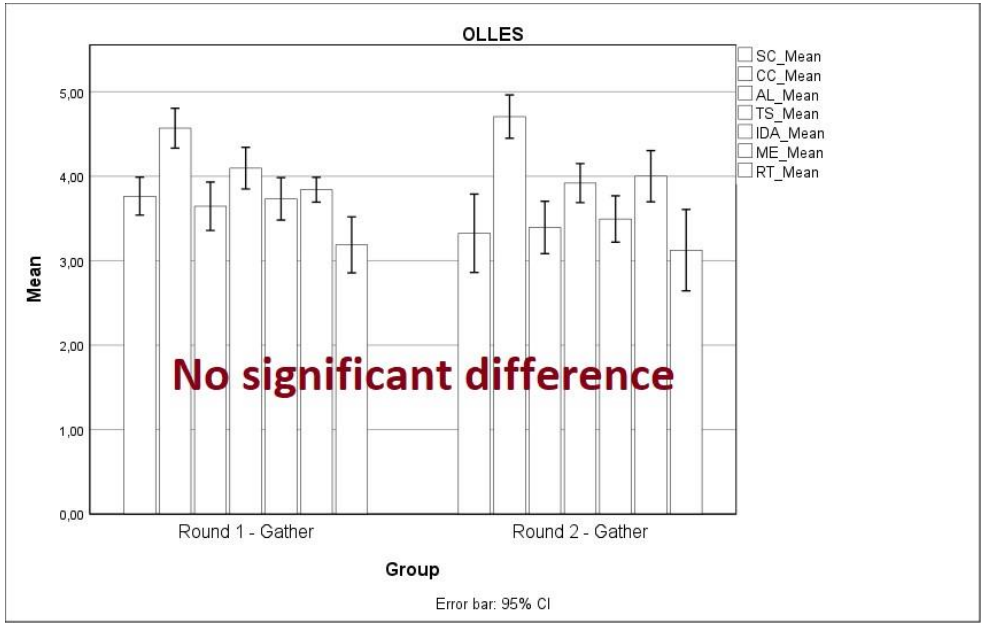
- Was there a change in the evaluation with regard to the repetition of the use of the gather.town environment?

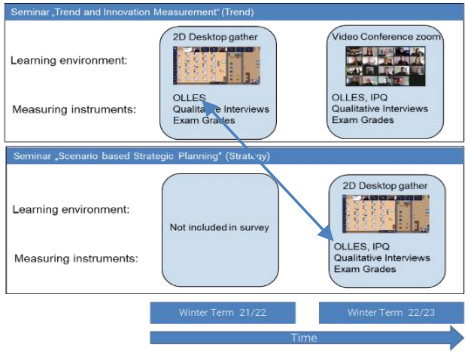
- The Wilcoxon test showed that there was no difference between measurement time point 1 and measurement time point 2 regarding the OLLES questionnaire.
- Significant differences between measurement time point 1 and measurement time point 2 at IPQ questionnaire
  - Variable G Student Collaboration (Exact Wilcoxon Test: z = -2.850, p = .002, n = 11)

- → no other significant differences between measurement time points, The difference in scale G could be explained by the fact that it consists of only one question item and therefore reacts much more strongly to minimal deviations.

VI. Results

- Comparison OLLES beetween Gather and Gather

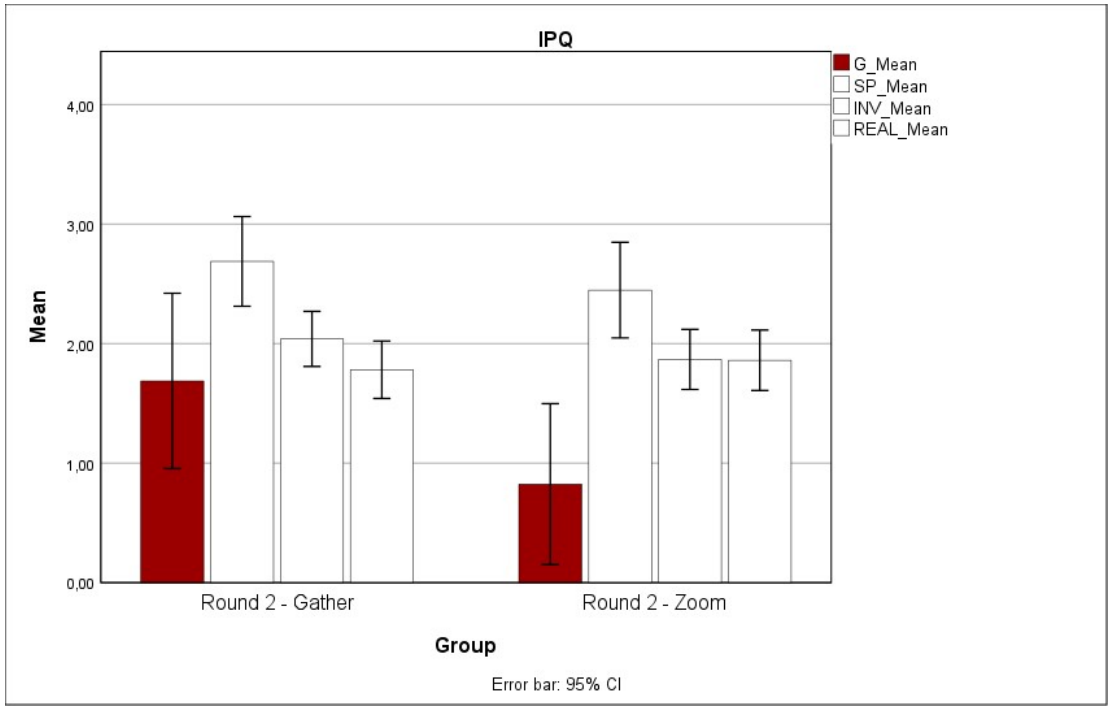


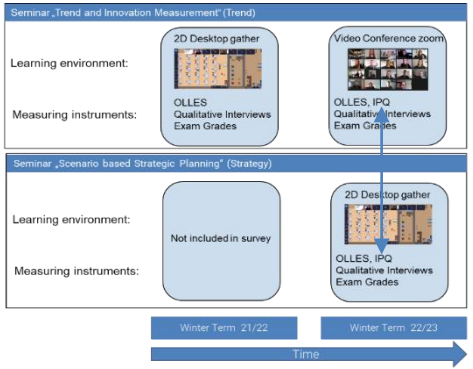


- Student Collaboration (SC),
- Computer Competence (CC),
- Active Learning (AL),
- Tutor Support (TS),
- Information Design and Appeal (IDA),
- Material Environment (ME),
- Reflective Thinking (RT)

VI. Results

- Comparison IPQ beetween Gather and Zoom

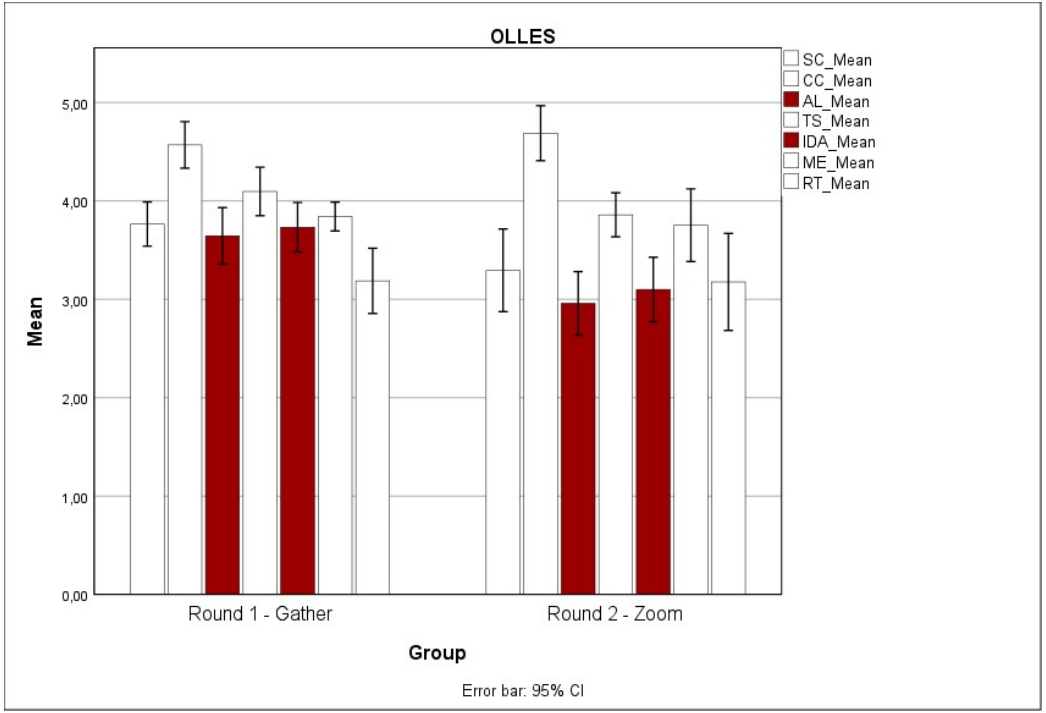


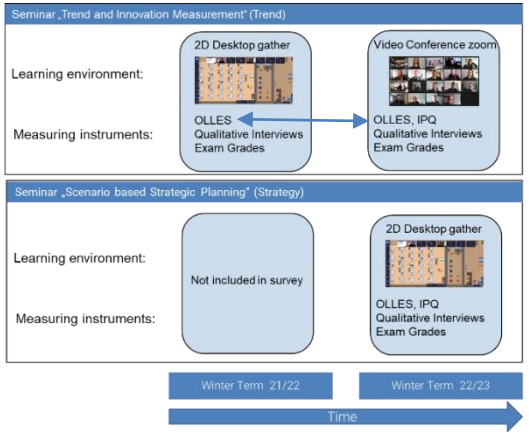


- G: general item that assesses the general "sense of being there". This item has high loadings on all three factors, with an especially strong loading on Spatial Presence.
- SP: Spatial Presence (the sense of being physically present in the VE)
- INV: Involvement (measuring the attention devoted to the VE and the involvmenet experienced)
- REAL: Experienced Realism (measuring the subjective experience of realism in the VE).

VI. Results

- Comparison OLLES beetween Gather and Zoom





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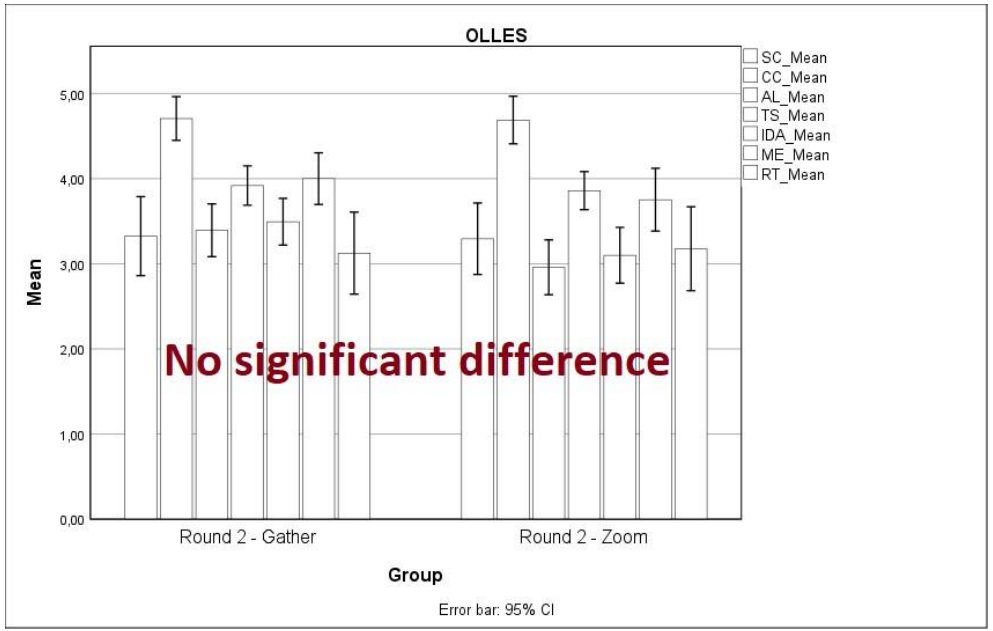

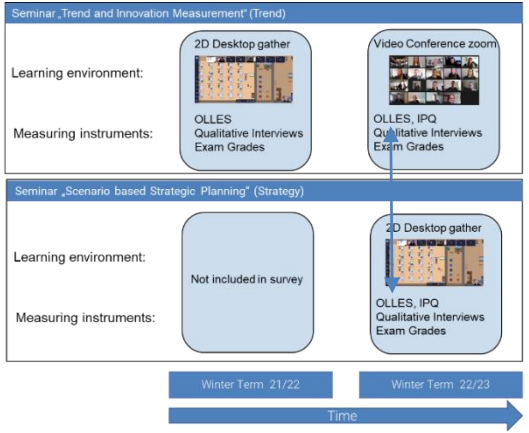

- Student Collaboration (SC),
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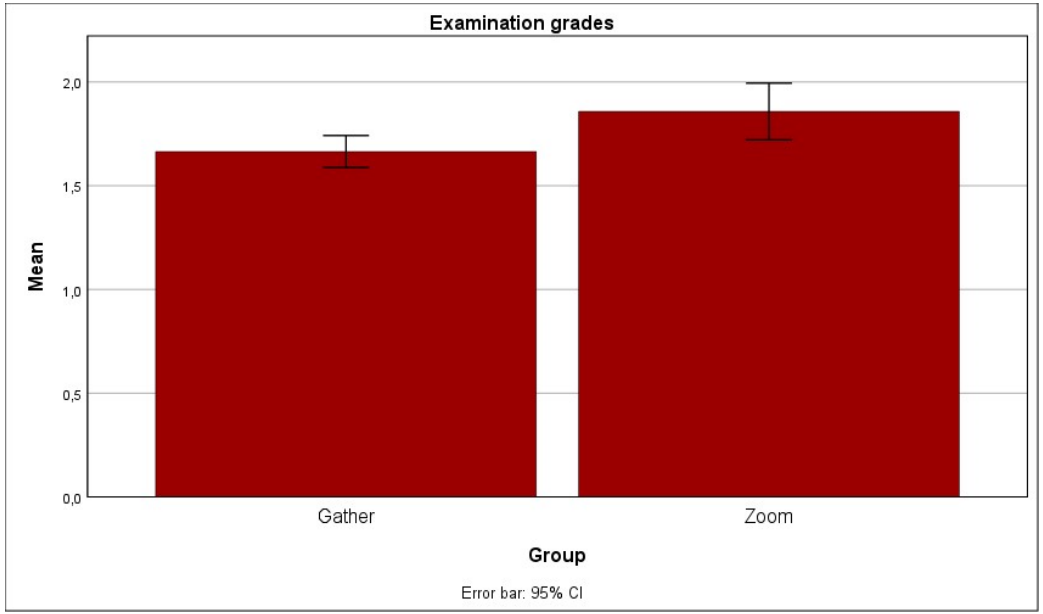
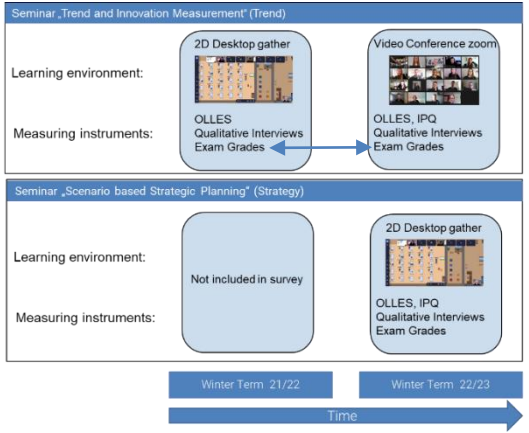
VI. Results

- Comparison Exam Grades beetween Gather and Zoom





Examination grade:
1: very good
2: good
3: satisfactory

VI. Results Qualitative Interviews

- Almost all subjects showed a hierarchy in their preferred choice of teaching styles. Classroom teaching is clearly preferred. This is followed by the use of 2D Virtual Environments. Classic video conferencing systems are least preferred.
- If we take a closer look at this hierarchy, we can see that the more opportunities for interaction and the more personal a teaching style is, the more it is preferred.
- This is also consistently confirmed by the responses to the qualitative questionnaire. Subjects consistently said they preferred gather.town over Zoom because they had more human proximity and also more opportunities to interact with other students.
- Nevertheless, ideally, they would like face-to-face teaching. This statement seems to be even more prevalent after the Corona pandemic. However, it also became clear that simple lectures could be replaced more easily by online teaching than seminars in which the focus is on working together.

VII. Discussion

- Comparison of two different seminars with different subjects in gather.town nevertheless resulted in equal evaluations of the Virtual Learning Environment regarding the OLLES questionnaire. Therefore, stable valuations can be assumed here.
- Comparison of the same seminar with different Virtual Learning Environments showed that gather.town scored significantly higher on the Active Learning (AL) and Information Design and Appeal (IDA) dimensions of the OLLES questionnaire than Zoom.
- The Active Learning (AL) dimension of the OLLES specifically asks about the motivation created, as well as the feedback received through the activities or the teaching unit within the environment itself. That there was increased motivation was confirmed by the interviews. The motivation arose primarily through increased interactivity. For the test persons, it was clearly more motivating to walk through the Virtual Environment by moving the avatar and not just to sit in front of the laptop. ..
- The dimension Information Design and Appeal (IDA) of the OLLES asks in particular how creative and original presented teaching materials are and whether graphics used are helpful and visually appealing. This mainly refers to the teaching slides presented as if they were in a presentation. Since the same learning materials were used here, this difference is difficult to explain. It is possible that the actual learning environment was included in the evaluation and not just the learning materials. Perhaps this double assessment was due to the fact that, in this particular case, it was not always clear to the subjects what the individual question items referred to in this dimension.

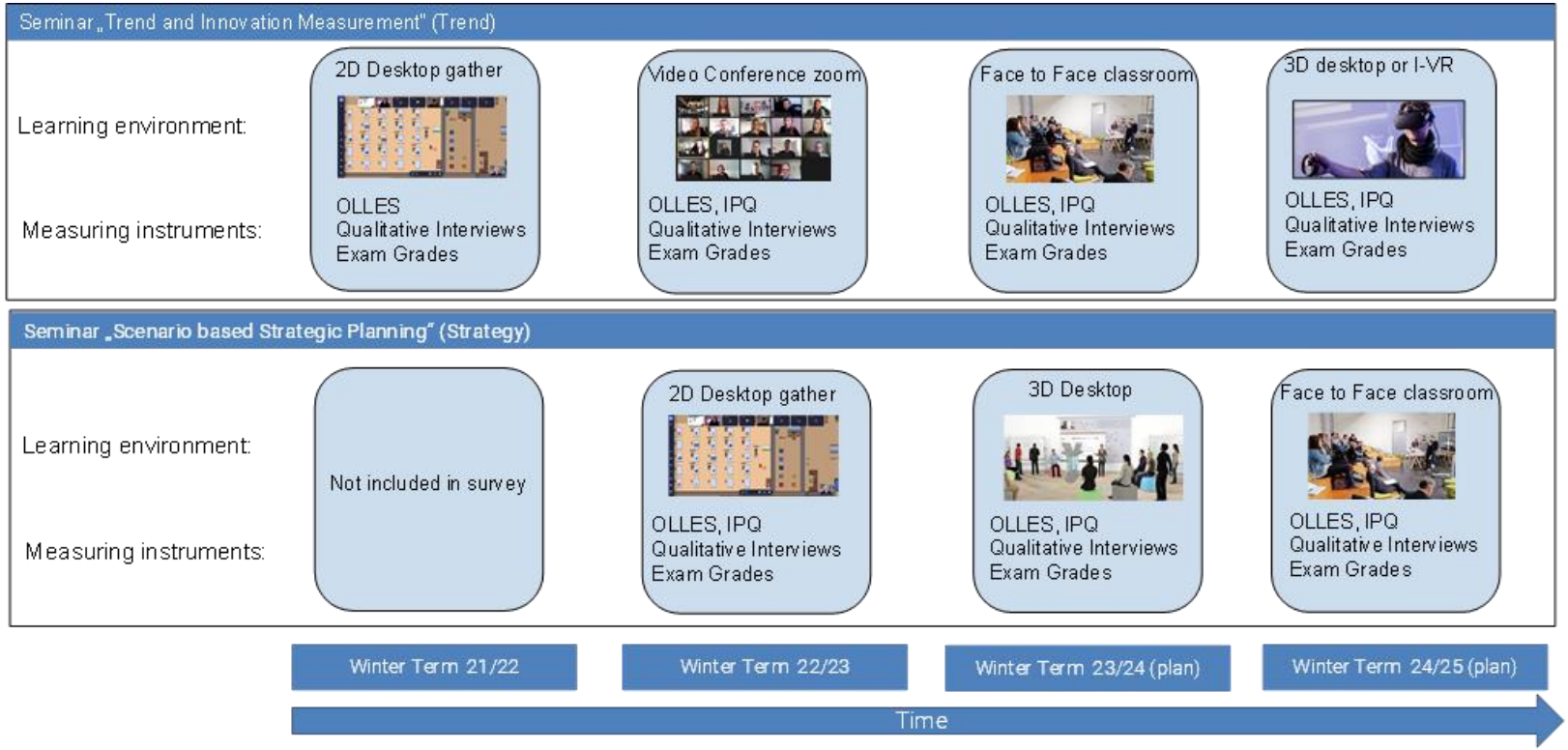
VII. Discussion

- There was a significant difference in the G scale of the IPQ, with gather.town showing a higher general presence than ZoomThe scale G (General Presence) of the IPQ asks solely about the sense of being there. This feeling could not be created at all with Zoom and at least minimally with gather.town. However, only in one of the two tests with different seminars. Whether there is an influence of the seminar on the evaluation of a Virtual Learning Environment is difficult to say.
- Nevertheless, the results found could also be due to a still small sample size. Statistically, however, the difference between the two Virtual Learning Environments turned out to be smaller than the qualitative interviews suggested. In the end, only partially significant differences in the evaluation could be found and these could not be repeated.
- Looking at the exam grades, a significant difference was found between the Virtual Learning Environments used. When using the gather.town environment the subjects had better grades than using the Zoom environment. This is a medium effect. Although there was not much difference in the assessment of Virtual Learning Environments, it does seem to have an impact on performance measurement in the form of exam grades. The results also confirmed that it is only possible to compare the same seminars with each other.

VIII. Conclusion

- This study shows that, according to the subjects, there is a hierarchy of teaching styles.
  - → First classroom teaching, then VLE like Gather.town then Video conferencing tools like zoom
- This hierarchy, especially the preference of face to face personal teaching is confirmed by several other studies [18] [19] [20] [21]. Also the preference for gather as 2D Desktop VR to zoom as classical video conferencing can be explained and confirmed by several studies [22] [23] [24] [25].
- It seems to be important to use VLE that are some kind of innovative, social emotional and engage formerly and informally communication, which seems to be better solved within the Virtual 2D Learning Environment gather.town.
- Contrary to the statements of the qualitative interviews, the quantitative evaluation of the two online teaching formats therefore seems to make no or only a very small difference.
- In contrast, when exam grades were measured as a performance measure, subjects were found to perform better with Virtual 2D Learning Environments than with traditional videoconferencing systems.

IV. Future Work



Many thanks for your attention

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