Why Should I Trust You? A Survey on Interpersonal Trust in Virtual Learning Environment

Marcelo Pereira Barbosa[1, 2], **Rita Suzana Pitangueira Maciel**[2]

[1]Instituto Federal do Piauí (IFPI) – Campus São João do Piauí
São João do Piauí-PI – Brasil

[2]Instituto de Informática – Universidade Federal do Bahia (UFBA)
Salvador – BA — Brasil

`marcelo.pereira@ifpi.edu.br, rita.suzana@ufba.br`

Abstract. One significant challenge of e-learning is enabling collaborative learning in Virtual Learning Environments (VLE). Trust among students is essential for student interaction in collaborative academic activities. Nevertheless, building trust is a complex, dynamic process, and factors for acquiring trust in VLEs remain a subject of ongoing investigation. In order to contribute to identifying some factors that influence the acquiring of trust among students in VLEs, we surveyed 119 students. The results revealed several characteristics influencing trust acquiring. Over 80 personal attributes were identified as capable of influencing trust among students, with "commitment", "participation", and "meeting deadlines" identified as the most influential trust factors.

1. Introduction

E-learning is a teaching modality that employs information and communication technologies to facilitate learning across various digital platforms. At the same time, it is beneficial for developing individual knowledge and skills; its true potential lies in fostering student collaboration. E-learning strategies encompass integrating multimedia content and instructional methodologies, such as practice and feedback, to enhance learning outcomes. These strategies may occur in a synchronous format, which encourages real-time interaction and collaboration, or in an asynchronous format, where students engage in self-paced learning and collaborate through discussion forums. This collaborative aspect is essential, as it enriches the learning experience and reflects the students' teamwork skills [Valverde-Berrocoso et al. 2020, Clark and Mayer 2023].

One of the challenges of e-learning is to enable collaborative learning on its platforms (Virtual Learning Environments (VLE)). VLEs should allow learners to interact socially and collectively to build new knowledge structures that enable learning based on the use of modern technology and media [Alzaın 2019, Venega and Maciel 2021]. Collaborative learning must be built and sustained through interpersonal trust among students as it is an enabler for meaningful and mutually beneficial interactions for collaboration [Anwar 2021]. Interpersonal trust is very important for social relationships and plays a key role in building relationships, shaping the way partners influence each other [Tomlinson and Langlinais 2021]. However, trust building is complex and difficult to establish in online environments [Wang and Benbasat 2008, Anwar 2021]. Once the trust has been built and is being maintained, the demands decrease for evidence of trustworthiness, but it can be quickly eroded [Currall and Epstein 2003]. The trust repair process is

not easy, and in some circumstances, no repair initiative will be able to restore the trust [Kähkönen et al. 2021].

Regarding e-learning, various trust aspects have been investigated, such as determining the intention to use e-learning platforms through trust [Younas et al. 2021], examining learners' level of trust in Massive Open Online Courses (MOOC) platforms [Costello et al. 2018], exploring how service quality and trust affect loyalty to e-learning [Pham et al. 2020]. Some studies evidence that trust affects the capability to share knowledge [Sedighehm and Ainin 2018], and is recognized as an important antecedent of group performance in virtual communities [Ridings et al. 2002], favors online student permanence [O'Brien 2002], and is essential for collaborative learning [Wegerif 1998]. However, the existing literature on trust in VLEs primarily focuses on analyzing trust in the platforms and features offered by these systems. Little attention has been paid to aspects related to students and their social interactions in virtual courses, especially from the students' perspective concerning the factors that influence trust acquisition. Given the inherent challenge of building trust in e-learning, our study aims to contribute to the identification of key factors that influence the acquisition of trust among students to promote interpersonal trust in e-learning environments.

To achieve our aim, we conducted a qualitative study using an online survey distributed to students in Brazil. The survey was available for approximately 60 days, during which we collected responses from 119 graduate student participants from 24 Brazilian states. We analyzed the data using qualitative content analysis with thematic analysis techniques, which allowed us to identify emerging patterns in the data [Clarke and Braun 2013]. The results show a diversity of factors that influence trust and provide participants' perceptions and experiences regarding trust influence in student collaboration. All data obtained from the survey can be accessed using the following link: https://bit.ly/4eLKja9.

This work offers contributions that may be utilized by educators, researchers, and VLE developers. For educators, understanding student preferences and behaviors that lead to trust development enables teaching strategies focused on strengthening trust among students, a crucial aspect for promoting a collaborative and effective learning scenario. Integrating practices that foster trust can significantly improve student engagement and cooperation in online activities, as evidenced by the literature [Wang and Chen 2012, Elghomary and Bouzidi 2019, Anwar 2021]. For researchers, this work contributes to understanding the dynamics of interpersonal relationships in online courses, thereby enabling the development and exploration of new research possibilities. The discussion section points out several open issues. For VLE developers, this work can be a basis for building tools that support interpersonal trust among students. Understanding the characteristics that promote trust can guide feature development that facilitates more trusting and collaborative interactions. This paper is structured as follows: Introduction, An overview on concepts of Trust and Related Works, Research methodology, Results, Discussion, Threats to validity, and Conclusion and Future Work.

2. An Overview on Trust Concepts

Trust is an important element in relationships and has aroused interest in many fields, including sociology, economics, and others [Fujihara 2013]. Trust can be defined as the

willingness of a trustor to believe, based on the expectation that the trustee will perform a particular action, regardless of monitoring or control structures [Mayer et al. 1995]. Trust relationships can occur between people (interpersonal) and between people and organizations (organizational) [Rotter 1967, Bachmann 2001].

Interpersonal trust is an expectation held by an individual that another individual or group can be trusted and is based on two dimensions: affective and cognitive [Rotter 1967, Bachmann 2001, Newman et al. 2014]. Affective or emotional development is based on continuous socio-emotional exchanges. Cognition-based trust is influenced by the credibility and competence observed in the other party involved and can be divided into two stages: initial and continuance [Schaubroeck et al. 2013]. Initial trust is based on beliefs formed without any prior experience or interaction between the two parties. When users gain more direct experience, initial trust develops into continuance trust [Koufaris and Hampton-Sosa 2004, Zhou 2012].

The factors influencing trust are primarily related to three characteristics of the trustee: (i) Ability: the capacity to influence outcomes in a specific domain. (ii) Integrity: the trustor's perception that the trustee adheres to a set of principles that he considers acceptable, and (iii) Benevolence: the trustee's altruism and motivation to act in the interest of others beyond a motive to gain some advantage [Mayer et al. 1995].

Several empirical research works have been performed to address aspects related to trust, including case studies ([Arnado et al. 2021, Morrison et al. 2012]), controlled experiments ([Mayfield and Valenti 2022, Ahmadian et al. 2022]). With regard to student trust towards their peers, few studies directly address this specific topic. Some research works focus on the measurement of trust, while other studies approach it in a complementary way in relation to its main object of analysis. Some research initiatives are described below.

In their study, [Wang and Chen 2012] aimed to explore students' emotions resulting from collaborative communication through qualitative-quantitative analysis and to measure student trust. A survey of 44 students was performed to explore emotions and measure trust levels. The study concluded that trust was built on collaboration among students. [Laifa et al. 2015] conducted the survey with 108 people and investigated how trust affects forgiveness in virtual teams in e-learning through a quantitative analysis. The results showed that learners tend to trust their virtual team and that learners who trust are more likely to forgive.

In [Costello et al. 2018] study, they aimed to examine the credibility of MOOCs through a qualitative-quantitative study. It investigated 76 students' trust beliefs in relation to course providers according to the constructs of benevolence, integrity, and competence. The research identified several motivating factors for trust towards MOOCs. [Wang 2014] conducted a quantitative study with 361 students to identify the factors that influence student trust in online courses. The survey included 12 items to assess the importance of inducing trust. The results suggest that trust is a precondition for the dissemination of information.

The studies reviewed addressed trust in e-learning, but none of the analyzed have objectives or research questions similar to ours. Moreover, only [Wang and Chen 2012] and [Costello et al. 2018] used qualitative-quantitative studies to achieve their objectives.

The study by [Wang 2014] is the one that most resembles ours. Despite not having research questions, it sought to identify the factors influencing students' trust in the platform that offers the courses. Both works seek to identify factors influencing trust, but [Wang 2014] work seeks to do this in relation to the platform itself, while our study does so in the social relationship between students.

3. Research Method

This survey was carried out following the procedures proposed by [Kasunic 2005], which comprises seven steps (Figure 1). In the next paragraphs, we detail our survey steps.
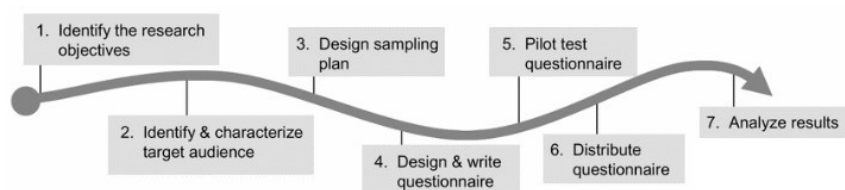

Figure 1. Research Method

Step 1 - Identify the Research Objectives. This study aims to identify the factors influencing interpersonal trust among students in e-learning. To this end, the study aims to understand how interaction takes place and which tools support interaction among students in VLEs; to identify the personal and relational characteristics perceived by students in their peers that inspire trust; and to explore the personal and relational characteristics that students consider crucial for the development of trust. To achieve the objectives, four Research Questions (RQ) were defined:

- RQ 1: How does interaction occur in e-learning?

  RQ 1.1 What features support interaction in E-learning courses?
  Rationale: This RQ aims to identify the tools used that supported interaction between students and to understand the purpose of interaction in this context. This will help to understand how students relate to each other and how these interactions can affect the trust.

  RQ 1.2 What factors influence students' choice of peers to collaborate?
  Rationale: The aim of this research question is to investigate what information students use to select partners for collaboration. By understanding the criteria used to form partnerships, it is possible to develop strategies that promote collaboration.

- RQ 2. Which student characteristics influence interpersonal trust in e-learning courses?
  RQ 2.1 What characteristics perceived in students inspire the initial trust?
  Rationale: With this RQ, we sought to identify the characteristics that students perceive in other students that inspire initial trust in e-learning environments before some interaction. By understanding which personal or behavioral characteristics lead students to trust each other, it is possible to develop strategies and interventions to promote initial trust in virtual learning contexts.

RQ 2.2 Which student characteristics can be considered to influence the acquisition of interpersonal trust in e-learning courses?

Rationale: This question aims to investigate what students consider to be the characteristics or events that influence the acquiring of interpersonal trust among students in e-learning. Understanding the influences that lead to the acquisition of trust over time will allow for a more comprehensive view of the factors that shape the relationships among students in this specific context.

Step 2 - Identify and Characterize the Target Audience. The target audience will be Brazilian students who are at least graduate students and who have had some kind of e-learning experience with other students that they did not know in person. Not having had any contact before the course is fundamental to understanding trust since if students have some knowledge about another, this knowledge can affect the initial trust.

Step 3 - Design the sampling plan. Since the aim of this research is to identify characteristics of trust in e-learning, we recruited students who have interacted with strangers in online courses. To identify students who have interacted with strangers, we put a filter question on the questionnaire and discarded the answers of those who had not had this kind of experience.

Step 4 - Designing and writing the questionnaire. The questionnaire (see appendix A) consists of 15 questions with open and closed questions aimed at answering each research question.

Step 5 - Pilot Test Questionnaire. We conducted a pilot test to ensure the quality of the questionnaire. In this phase, we invited 10 students to answer the questionnaire and provide feedback on its clarity, comprehensiveness, and relevance. Subsequently, we refined the questionnaire based on the analysis of all responses and feedback from participants. We assessed their understanding of the questions and examined the consistency of their answers, identifying and correcting any possible issues before making the final questionnaire available.

Step 6 - Distributing the questionnaire. We sent emails to the course coordinators and asked them to disseminate the survey to their students. The emails were collected from the educational institution's website. We carefully clarified the objective, the expected duration to answer the survey; and the structure of the questionnaire. We presented the Informed Consent Form for them to read and agree to before completing the questionnaire, to ensure ethical standards and preserve the anonymity of the participants.

Step 7- Analyze the results. The data analysis process and coding were performed using thematic analysis techniques guided by the procedures proposed in [Clarke and Braun 2013]. In the coding phase, we employed a thorough systematic approach, covering semantic types (based on the semantic meaning of the data). By combining these codes, our analysis aimed to provide a holistic understanding of the dataset, capturing the explicit and implicit dimensions of the information extracted. Initially, we familiarized ourselves with all the extracted data, reading and re-reading it to understand the content. We then performed coding and assigned codes to each part of the extracted data, focusing on the characteristics that can influence interpersonal trust. The next step was to look for patterns in the codes, grouping them into categories that reflected a broader idea. As the aim of this research is to explore the data on interpersonal trust in e-learning,

in this article we only present the classification of the data so that the characteristics of interpersonal trust are as transparent as possible.

4. Results

This section presents the characteristics of the sample population participating in our survey study and the RQ data analysis. A summary of the findings is provided at the end of each RQ.

Regarding demographic data, our study gathered responses from 119 (51% Male, 47% Female, and 2% I prefer not to inform) students from 24 Brazilian states and all regions of the country (Center-West: 8; Northeast: 47; North: 7; Southeast: 38; South: 19).

Regarding the respondent profile, 88% of respondents had already taken online courses before social isolation, 53% had taken between 1 and 5 courses, 25% had taken between 6 and 10 courses, and 22% had taken more than 10 courses. In total, 36 VLEs were mentioned, with Moodle being the most used platform at 44%, followed by SIGAA at 23%, Udemy at 6%, Google Classroom at 5%, AVAMEC at 3%, Canvas at 3%, and Coursera at 2%. The other platforms mentioned did not reach more than 1%.

4.1. RQ 1. How does interaction occur in e-learning?

As previously stated, the objective was to ascertain which functionalities facilitated collaboration in academic activities and what factors were considered when selecting peers. Only respondents who had collaborated with peers with whom they were previously unacquainted answered the entire questionnaire. Notably, 434 students volunteered to participate, of whom 27% (119) stated that they had collaborated in academic activities with unknown peers.

As previously stated, the RQ1-associated questionnaire's questions pertain to interaction and collaboration, with no mention of trust concepts. With regard to RQ 1.2, the coding process entailed grouping the data. Initially, we familiarized ourselves with all the responses, then extracted the characteristics, and finally grouped the similar characteristics into categories.

4.1.1. RQ 1.1 What features support interaction in E-learning courses?

To understand how interaction among students occurs in e-learning, we asked respondents to describe their interactions with unknown people, and what tools or software functionalities were used [Lima and Maciel 2021]. Figure 2 shows the data related to the interactions, such as the purpose of the interaction, the percentage of the purpose of the interaction in the VLE (dark green bar), and outside the VLE (light green bar) and the list of tools used.

The tools most used by students for interaction in VLEs are forums (34%) for discussions, debates, and questions; Chat (12%) and the platform's native tools for video-conferencing (5%) for synchronous communication; text messages within the VLE (2%) for asynchronous communication; and Wiki (1%) for collaborative content construction.

Regarding interaction that took place outside the VLEs, the students reported a greater variety of tools, such as Whatsapp (17%) for text, voice, and video communication was the most used tool outside the VLEs; Telegram (1%), Discord (1%) and Slack (1%) were also used for the same purpose; and Google Meet (10%), Zoom (2%) and MS Teams (1%) supported videoconference meetings for students. Students also used various tools to perform out collaborative activities during the e-learning courses, such as Google-Docs (3%), Mentimeter (1%), Miro (1%), Padlet (1%), Google Colab (1%) and Jamboard (1%). Other tools mentioned were e-mail (5%) for asynchronous communication and a comments section (1%) for giving feedback to other students on collaborative activities.

We highlight that 73% of the tools utilized for interaction among students are not native to VLEs. Furthermore, students did not identify any specific features for peer selection.
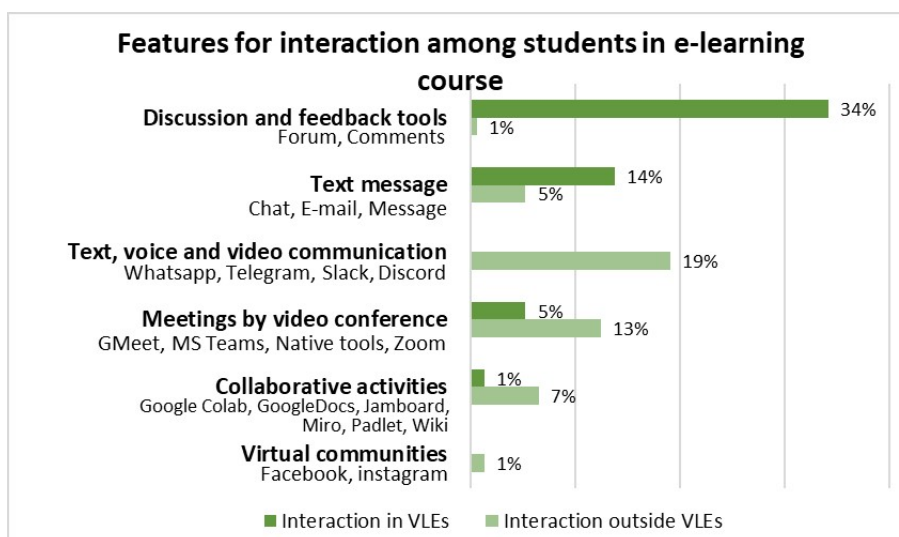

Figure 2. Features for Students Interaction

4.1.2. RQ 1.2 What factors influence students' choice of peers to collaborate?

As previously mentioned, our respondents interacted with other students whom they had never met in person. Of these, 34% chose partners for collaboration, while 66% were chosen or participated in some random team-building dynamic in the courses. We investigated the factors used by the students to choose other students for collaboration, using an open question: *What criteria they used to choose the members for the collaborative activities?* The students answered spontaneously about what motivated them to make this choice. After the coding process, we obtained 14 characteristics that led students to choose partners for collaboration.

The characteristic most commonly used when choosing partners for collaboration was Personal affinity (28%), referring to students selecting collaborators with whom they have some kind of identification. Other characteristics observed in the process of selecting partners for collaboration were: Based on past interactions (15%), selection of collaborators based on previous experiences; Area of interest (10%), selection of partners with similar interests; Academic area (8%), selection of partners with an academic formation; Commitment to the course (8%), selection of partners who fulfill their obligations to the course and to other students; and Random choice (13%) random selection of employees

without specific criteria. The other criteria used by the students when choosing their peers can be seen in the figure 3.
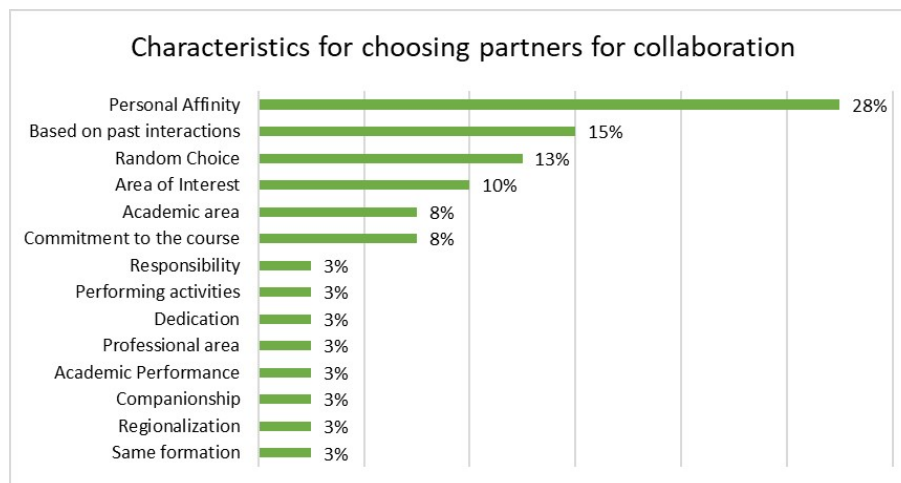

Figure 3. Criteria for choosing partners for collaboration on VLEs

RQ 1. Findings
- Usually, students avoid collaborating with previously unknown peers. When they engage in such collaborations, students tend to select their peers based on several characteristics, with personal affinity, past interactions, and area of interest being the most prevalent. However, random choice is a common practice. Furthermore, interactions among students predominantly occur through tools not native to VLEs and do not cite any feature to support peer selection.
- The use of non-native VLE tools for interactions and the lack of features supporting peer selection may hinder the collection and automatic analysis of data related to interpersonal trust, potentially hampering the development of effective trust-building strategies and collaborative learning environments.

4.2. RQ 2. Which student characteristics influence interpersonal trust in e-learning courses?

In this RQ, we identified the personal and behavioral characteristics that can influence students' trust acquisition in e-learning courses. Of the 119 respondents, 83% said that trust is determinant for collaboration in virtual courses (*Was trust in the student a determining factor in choosing them to carry out collaborative activities?*). The students also reported, through open questions, which characteristics perceived in other students influenced the acquisition of trust. For these questions, students could list as many characteristics as they wanted.

In this RQ, we conducted data analysis using thematic analysis techniques for coding. Initially, we read all the responses to familiarize ourselves with the data, and then we carried out the process of extracting relevant information for our research. Subsequently, we grouped similar data into a more comprehensive classification. The classification was conducted using a bottom-up approach guided by the data, that is, based on what is in the data.

4.2.1. RQ 2.1 What personal characteristics of the participants made you trust them?

We asked which characteristics they observed led them to trust to collaborate with other students before any previous interaction. We obtained 36 characteristics that inspired trust in other students. The most reported were student's Commitment to the course (17%), Active participation in classes, forums, and assignments (9%), Dedication (6%), Personal affinity (6%) for having common interests, Showing interest (6%), and Good results (5%). The other characteristics identified can be seen in figure 4. Figure 4 shows that most of the characteristics cited are related to student behavior, such as Dedication to course activities, Punctuality, or Cooperation with other students. To a lesser extent, it is possible to see personal characteristics that are more static and do not depend exclusively on behavioral change, such as characteristics relating to the affinity among students influenced by the Academic area or even Regional proximity.
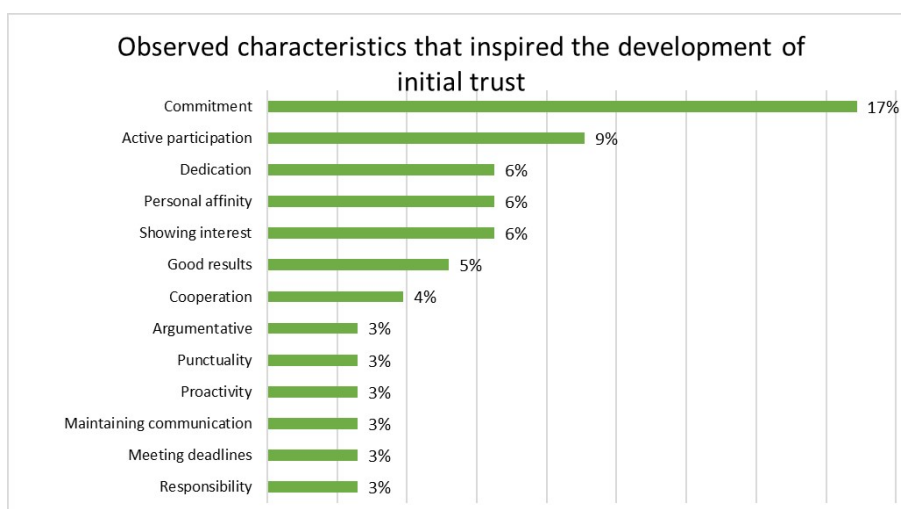

Figure 4. Observed characteristics that inspired the development of initial trust among students in e-learning

In addition to the characteristics shown in figure 4, the students reported others that also inspired trust but were not included in the figure for organizational reasons. Each of these characteristics represents 1% of the total number of quotes. They are Academic area, Attendance in class, Being communicative, Being objective, Coherent answers, Companionship, Confidence in discussions, Empathy, Enjoying interaction, Friendship, Giving feedback, Good communication, Interest in similar areas, Interest in the study, Intimacy, Knowing the other students, Maintaining focus, Past interactions, Performing activities, Regional proximity, Relevant and well-written answers, Showing respect, and Sympathy.

4.2.2. RQ 2.2 Which student characteristics can be considered to influence the acquisition of interpersonal trust in e-learning courses?

In this RQ we identify the characteristics that students consider can influence the acquiring of trust. To do this, we asked students an open-ended question where they could list as many characteristics as they wanted: *What characteristics of a student in e-learning environments can cause the acquiring trust?* In total, we identified 74 (82 considering

RQ 2.1) characteristics that can influence the acquiring of trust in the students' perception. The five most cited characteristics that students consider capable of influencing trust were also identified in the students from the investigation of RQ 2.1: Commitment to the course (11%), Active participation (5%), Meeting deadlines (5%), Responsibility (5%), and Showing interest (4%). 38% (28) of the characteristics had already been identified by the students from observation of their peers (RQ 2.1), and 62% (46) are characteristics that the students consider influential but which they were unable to observe in other virtual course students. Student commitment (11%), active participation (5%), meeting deadlines (5%), and responsibility (5%) were the most cited of these characteristics. Meeting deadlines was cited more frequently in this RQ than the student observation investigated in RQ 2.1.

Regarding the characteristics that were not mentioned in RQ 2.1, technical knowledge was the characteristic often mentioned by students (3%), followed by Allocating time for course activities (2%), Fulfilling obligations (2%), Honest attitudes (2%), sharing ideas and knowledge (2%), Teamwork (2%) and Willingness to help (2%). A characteristic which was not intrinsically related to the student and which was indicated as capable of influencing trust was the use of the camera during moments of interaction in virtual environments. We present in figure 5 the characteristics that students consider to influence trust, which were not listed in RQ 2.1.

Figure 5. Characteristics of students that lead to the acquisition of trust in the perception of virtual course students

Correlating RQ1.2, 2.1, and 2.2, we observed that characteristic Personal affinity was the most cited in the choice of peers (RQ1.2). However, Personal affinity no longer has the same intensity in the perception of trustworthiness in peers (RQ2.1) and has no relevance as a characteristic for acquiring trust (RQ2.2). Possibly due to the lack of specific support for choosing peers, Personal Affinity becomes an option.

RQ 2. Findings
- Factors inherent to student behavior are strongly linked to the process of building trust in virtual courses, mainly stemming from commitment to the course as the main factor for acquiring trust.
- Soft skills are highly valued by students in virtual learning environments, with most of them being cited for the process of acquiring trust.
- In the students' perception, Personal Affinity is not a relevant characteristic for

> initial and acquiring trust. However, it was widely used to choose peers.

5. Discussion

This survey results identified several characteristics associated with student interaction in VLEs, indicating that, for students, trust is a determining factor for collaboration. However, most of the students who took the time to answer the questionnaire did not collaborate with peers they did not know previously. At the same time, those who had had this experience were allocated peers through random strategies. We consider this evidence to be relevant and worthy of further investigation. Moreover, we identified 82 characteristics of interpersonal trust that influence interpersonal trust and inspire confidence in the student's choice of collaboration.

Most of the characteristics identified in our research can be classified according to [Mayer et al. 1995]: 47% of the characteristics identified can be classified as Ability (e.g. Technical knowledge, Good communication, and Leadership) 46% as Integrity (e.g. Responsibility, Honesty, and Respect) and 5% as Benevolence (e.g. Willingness to help, Companionship, and Motivates other students). Some of the characteristics were not possible to use from the [Mayer et al. 1995] classification, such as characteristics relating to affinity among students, such as Regional proximity, Similar interests, and the Same Academic area. In addition, some factors that were not intrinsically related to the student, such as keeping the Camera on during interactions, were also not possible to classify.

With regard to features that support collaboration among students, most of the features used during peers interaction are not native to VLEs. In addition, no features were identified in the VLEs that directly aim to support trust as an aspect of supporting collaboration. Although some studies [Chamba-Eras et al. 2023, Miguel et al. 2014, Ahmadian et al. 2022], suggest mechanisms to promote trust in VLEs, students did not mention using these features.

Regarding the characteristics that students used to choose their peers, Personal affinity is the most used factor but not cited as a key factor for interpersonal trust. In addition, Commitment is the most cited factor in the key acquiring trust, and little explored in the choice of partner for collaboration, possibly indicating a lack of tools for perceiving Commitment. Compliance with Meeting deadlines and Responsibility also fit into this scenario.

In other domains, for instance, sales, trust factors are more pragmatic, such as meeting delivery deadlines, response times in customer communication, and product quality. However, interpersonal trust attributes in academic collaboration are more sensitive and subjective, varying from person to person and less quantifiable. Therefore, it makes supporting trust in VLE more challenging. Despite this, as software increasingly permeates modern society, addressing this challenge is essential for fostering effective student collaboration.

As open issues in supporting interpersonal trust in e-learning, we can list some possibilities (i) the possibility of interoperability with social networking platforms to collect trust data from student social interactions, (ii) the use of profiles with trust indicators, which can include information on ability, benevolence, integrity and personal characteristics, (iii) studies of strategies to recommend trustworthy peers and promote trust in this

educational context (e.g. recommendation systems, LLM, etc.), (iv) the impact of data protection laws and rules to ensure student privacy, and (v) models for representing interpersonal trust to support the development of VLE functionalities.

6. Threats to validity

Construct Validity: To increase the construct validity of our research, we strictly followed what is proposed by [Kasunic 2005] for conducting a survey. The Survey design was carried out by two researchers.

Internal validity: To increase the internal validity of our survey, we pilot-tested the questionnaire with a small group of participants to mitigate doubts about the interpretation of the questions, which allowed us to identify any ambiguous or unclear questions and make necessary revisions to improve clarity and accuracy

External validity: Although efforts were made to obtain a diverse group, the sample we obtained may not be statistically representative of the entire population, nevertheless we were able to gather responses from a significant number of states, capturing a diverse range of e-learning trust characteristics and the results offer significant insights into trust among students.

Reliability: To mitigate interpretation bias, the research team collaborated closely throughout the coding process. Two researchers engaged in extensive discussions to address any discrepancies in code assignments.

7. Conclusion and Future Work

This research aimed to identify the factors that influence students' interpersonal trust in e-learning. To achieve our goal, we conducted an online survey with 119 Brazilian graduate students from all regions of Brazil, which allowed us to gain an insight into trust in different cultures. Several characteristics were listed by the students. However, due to a lack of information about the other students, random choices are still used.

Based on the factors identified in this research, software development professionals interested in VLEs can promote environments that are more conducive to creating bonds of trust among students, such as using machine learning techniques to collect new attributes that can influence the acquisition of trust or developing recommendation systems based on the characteristics that influence trust,

In future work, we intend to fill the gap in the literature on interpersonal trust in virtual courses by identifying characteristics that influence interpersonal trust among students in the four evolutionary phases of acquiring, maintaining, losing and restoring trust.

Acknowledgements

References

Ahmadian, S., Ahmadian, M., and Jalili, M. (2022). A deep learning based trust-and tag-aware recommender system. *Neurocomputing*, 488:557–571.

Alzaın, H. A. (2019). The role of social networks in supporting collaborative e-learning based on connectivism theory among students of pnu. *Turkish online journal of distance education*, 20(2):46–63.

Anwar, M. (2021). Supporting privacy, trust, and personalization in online learning. *International Journal of Artificial Intelligence in Education*, 31(4):769–783.

Arnado, J. M., Jabal, R. F., Poa, M. R. J. A., and Viray, T. C. (2021). Trust in pandemic-induced online learning: Competitive advantage of closure and reputation. *RISE*, 10(2):192–217.

Bachmann, R. (2001). Trust, power and control in trans-organizational relations. *Organization studies*, 22(2):337–365.

Chamba-Eras, L., Arruarte, A., and Elorriaga, J. A. (2023). T-vlc: A trust model for virtual learning communities. *IEEE Transactions on Learning Technologies*, 16(5):847–860.

Clark, R. C. and Mayer, R. E. (2023). E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning. pages 1–520.

Clarke, V. and Braun, V. (2013). Successful qualitative research: A practical guide for beginners. *Successful qualitative research*, pages 1–400.

Costello, E., Brunton, J., Brown, M., and Daly, L. (2018). In moocs we trust: Learner perceptions of mooc quality via trust and credibility. *International Journal of Emerging Technologies in Learning*, 13(6):214–222.

Currall, S. C. and Epstein, M. J. (2003). The fragility of organizational trust:: Lessons from the rise and fall of enron. *Organizational Dynamics*, 32(2):193–206.

Elghomary, K. and Bouzidi, D. (2019). Dynamic peer recommendation system based on trust model for sustainable social tutoring in moocs. In *2019 1st International Conference on Smart Systems and Data Science (ICSSD)*, pages 1–9. IEEE.

Fujihara, Y. (2013). Toward dependable online peer assessments a concept of the trust manegement on peer assessments. In *2013 IEEE Region 10 Humanitarian Technology Conference*, pages 110–111. IEEE.

Kähkönen, T., Blomqvist, K., Gillespie, N., and Vanhala, M. (2021). Employee trust repair: A systematic review of 20 years of empirical research and future research directions. *Journal of Business Research*, 130:98–109.

Kasunic, M. (2005). Designing an effective survey. Technical report, Carnegie-Mellon Univ Pittsburgh PA Software Engineering Inst.

Koufaris, M. and Hampton-Sosa, W. (2004). The development of initial trust in an online company by new customers. *Information & management*, 41(3):377–397.

Laifa, M., Giglou, R. I., Akhrouf, S., and Maamri, R. (2015). Trust and forgiveness in virtual teams: A study in algerian e-learning context. In *2015 International Conference on Interactive Mobile Communication Technologies and Learning (IMCL)*, pages 131–135. IEEE.

Lima, M. d. S. and Maciel, R. S. P. (2021). Practices and digital technological resources for remote education: an investigation of brazilian professor's profile. In *Anais do XXXII Simpósio Brasileiro de Informática na Educação*, pages 225–236. SBC.

Mayer, R. C., Davis, J. H., and Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of management review*, 20(3):709–734.

Mayfield, C. O. and Valenti, A. (2022). Team satisfaction, identity, and trust: a comparison of face-to-face and virtual student teams. *Active Learning in Higher Education*, pages 213–226.

Miguel, J., Caballé, S., Xhafa, F., Prieto, J., and Barolli, L. (2014). A collective intelligence approach for building student's trustworthiness profile in online learning. In *2014 Ninth International Conference on P2P, Parallel, Grid, Cloud and Internet Computing*, pages 46–53. IEEE.

Morrison, R., Cegielski, C. G., and Rainer, R. K. (2012). Trust, avatars, and electronic communications: Implications for e-learning. *Journal of Computer Information Systems*, 53(1):80–89.

Newman, A., Kiazad, K., Miao, Q., and Cooper, B. (2014). Examining the cognitive and affective trust-based mechanisms underlying the relationship between ethical leadership and organisational citizenship: A case of the head leading the heart? *Journal of business ethics*, 123(1):113–123.

O'Brien, B. (2002). Online student retention: can it be done? pages 1–6. Association for the Advancement of Computing in Education (AACE).

Pham, C., Vu, N., and Tran, G. (2020). The role of e-learning service quality and e-trust on e-loyalty. *Management Science Letters*, 10(12):2741–2750.

Ridings, C. M., Gefen, D., and Arinze, B. (2002). Some antecedents and effects of trust in virtual communities. *The Journal of Strategic Information Systems*, 11(3):271–295.

Rotter, J. B. (1967). A new scale for the measurement of interpersonal trust1. *Journal of Personality*, 35(4):651–665.

Schaubroeck, J. M., Peng, A. C., and Hannah, S. T. (2013). Developing trust with peers and leaders: Impacts on organizational identification and performance during entry. *Academy of Management Journal*, 56(4):1148–1168.

Sedighehm, M. and Ainin, S. (2018). Effect of trust and perceived reciprocal benefit on students knowledge sharing via fb and academic performance. *The Electronic Journal of Knowledge Management*, 16(1):23–35.

Tomlinson, E. and Langlinais, L. (2021). The relationship between trust and attributions: A levels-of-analysis perspective. pages 66–86.

Valverde-Berrocoso, J., Garrido-Arroyo, M. d. C., Burgos-Videla, C., and Morales-Cevallos, M. B. (2020). Trends in educational research about e-learning: A systematic literature review (2009–2018). *Sustainability*, 12(12):1–23.

Venega, V. d. S. and Maciel, R. S. P. (2021). Requirements for development of cmooc platforms from the professional's perspective. In *Anais do XXXII Simpósio Brasileiro de Informática na Educação*, pages 80–90. SBC.

Wang, M.-j. and Chen, H. C. (2012). Emotions and pair trust in asynchronous hospitality cultural exchange for students in taiwan and hong kong. *Turkish Online Journal of Educational Technology-TOJET*, 11(4):pages 119–131.

Wang, W. and Benbasat, I. (2008). Attributions of trust in decision support technologies: A study of recommendation agents for e-commerce. *Journal of Management Information Systems*, 24(4):249–273.

Wang, Y. D. (2014). Building student trust in online learning environments. *Distance Education*, 35(3):345–359.

Wegerif, R. (1998). The social dimension of asynchronous learning networks. *Online Learning*, pages 34–49.

Younas, A., Faisal, C. N., Habib, M. A., Ashraf, R., and Ahmad, M. (2021). Role of design attributes to determine the intention to use online learning via cognitive beliefs. *Ieee Access*, 9:94181–94202.

Zhou, T. (2012). Understanding users' initial trust in mobile banking: An elaboration likelihood perspective. *Computers in human behavior*, 28(4):1518–1525.

A. Survey questions

Questions of the survey form, indicating its type: (C: Closed; O: Open) and related research questions (goal).

#	Question	Type	Goal
Q1	What is your level of education?	C	Demographics
Q2	What is your age group?	C	Demographics
Q3	What is your gender?	C	Demographics
Q4	In which Brazilian state do you live?	C	Demographics
Q5	Have you used any virtual teaching/learning platform (E-learning)?	C	Demographics
Q6	How many courses using E-learning platforms have you taken?	C	Demographics
Q7	List below the platforms (Website or Apps) you used to take the E-learning courses.	O	Demographics
Q8	Regarding your participation in E-learning platforms, did you work alone or interact with other students?	C	RQ 1.
Q9	In your participation in E-learning platforms, did you interact with people you didn't know in person?	C	RQ 1.
Q10	If yes to the previous question, please describe in detail how the interaction occurred.	O	RQ 1.
Q11	In your participation in E-learning platforms, did you choose members of work groups?	C	RQ 1.
Q12	If yes to the previous question, what criteria did you use to choose group members?	O	RQ 1.
Q13	Still regarding reasons for choosing members of your work group, was trust in another person a determining factor for your choice?	C	RQ 2.
Q14	If yes to the previous question, what were the characteristics of the participants that made you trust them?	O	RQ 2.
Q15	What personal/behavioral characteristics do you consider capable of fostering acquiring trust?	O	RQ 2.

Table 1. Survey Questions