

TrustMatchMaker: Materializing Interpersonal Trust in VLE

Marcelo Pereira Barbosa^{1,2}, Fabrício dos Santos Silva², João Silva Soares²,
Rita Suzana Pitangueira Maciel²

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

²Instituto de Computação – Universidade Federal do Bahia (UFBA)
Salvador – BA — Brasil

marcelo.pereira@ifpi.edu.br, barbosamarcelo@ufba.br fabriciosilva@ufba.br
soaresj@ufba.br, rita.suzana@ufba.br

Abstract. *Trust is a multifaceted and dynamic phenomenon, which makes it challenging to support in software systems. This article presents a prototype to support trust among students in Virtual Learning Environments (VLEs). Based on previous studies, five features emerged: trust profile, peer review, collaborative teams, network of friends, and recommendation mechanism. These features reflect key properties of trust, such as subjectivity, asymmetry, propagation, and evolution over time. The prototype allows students to evaluate their peers, recognize positive behaviors, and identify trustworthy students. In the validation process, participants highlighted the solution's potential to improve collaborative practices by helping students identify trustworthy peers.*

1. Introduction

Trust leads students to interact and collaborate in Virtual Learning Environments (VLEs) to carry out academic activities. Students tend to trust or select their partners based on affinities or personal assessments related to integrity, skills and the propensity to act as expected in a given context, with a view to obtaining good results [Barbosa and Maciel 2025].

Trust is essential for success in virtual courses, as it facilitates interactions among students, encourages the formation of groups and directly influences the choice of partners for collaborative activities and strengthens social relationships [Feng and Xu 2020, Anwar 2021]. However, identifying trustworthy individuals becomes more complex in virtual contexts, since the absence of physical presence compromises the perception of non-verbal signals and other relevant social cues. This limitation hinders the development of interpersonal trust, making it challenging to identify factors or characteristics that can promote it in computer-mediated environments [Wang and Benbasat 2008, Anwar 2021]. As a consequence, a lack of trust can cause resistance to the intention to share knowledge, leading to demotivation, disinterest and lower student retention in online courses [O'Brien 2002, Wang 2014, Kunthi et al. 2018, Elghomary and Bouzidi 2019, Almaiah et al. 2020].

Several studies address interpersonal trust among students in VLEs [Elghomary and Bouzidi 2019, Baturay and Toker 2019, Miguel et al. 2014]. Through a systematic mapping of the literature, we identified 37 personal and behavioral attributes

associated with trust [Barbosa and Maciel 2025]. However, as these characteristics originate from domains other than VLEs, we expanded the investigation with a survey applied to virtual course students, with the aim of understanding, from the students' own perspective, which attributes influence the building of trust, which resulted in the identification of 82 relevant characteristics [Barbosa and Maciel 2024].

To address the complexity and subjectivity of interpersonal trust, this article presents TrustMatchMaker, a prototype which translates theoretical and empirical findings into software features integrated into a VLE. Unlike previous approaches that focus on narrower strategies, our solution combines multiple mechanisms, such as peer evaluation, recommendation systems, and a trust profile, to reflect the multifaceted nature of trust. The prototype was validated in two phases involving professionals and students, whose feedback highlighted the proposal's relevance and usefulness. Participants particularly emphasized the proposal's potential to improve collaboration by supporting trust-based interactions among students and to supporting software development. Trust-matchMaker is part of a research project that aims to provide a set of requirements for remote learning environments ([Barbosa and Maciel 2024], [Venega and Maciel 2021], [Lima and Maciel 2021], [Lima et al. 2024]) and has been approved by the ethics committee under number 84044824.9.0000.5211, with reasoned opinion No. 7,678,485. This article is organized as follows: Introduction, Trust in VLEs, Research Method, Proposed TrustMatchMaker: Supporting Trust in VLEs, Proposal Validation, and Conclusion and Future Work.

2. Trust in VLE

Interpersonal trust as the expectation that one can rely on the word, promise or statement of another individual or group [Rotter 1967]. It involves recognized interdependence and a willingness to accept risks based on positive expectations about the other's future actions [Borum 2010]. Interpersonal trust occurs between a trustor (the one who trusts) and a trustee (the one who is trusted), and is based on perceived attributes in the other, being a multidimensional construct that encompasses cognitive and emotional dimensions [Elghomary et al. 2019, Schaubroeck et al. 2013].

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]. However, if these characteristics cannot be identified, personal affinity becomes an important factor in building trust among people [Barbosa and Maciel 2024].

Interpersonal trust has certain properties [Elghomary et al. 2019]: *Asymmetrical*, it is not equivalent, it is personalized and subjective, as two people have different opinions about the same person; *Transitive*, considering that A trusts B, who trusts C, then A tends to trust C; *Propagative*, in a social environment, information about trust can be conveyed indirectly, allowing values to be aggregated between entities that are not directly connected; and *Dynamic*, trust changes over time or for a specific task or goal. The dynamics of trust involve evolutionary phases: acquisition, loss, maintenance, and restoration [Currall and Epstein 2003, Fachrunnisa et al. 2010][Anwar 2021].

As we have seen, trust can extend beyond the direct relationship between two people and can form even without direct connections, being influenced by indirect relationships mediated by third parties, which allows the formation of trust networks (second-hand trust) [McEvily et al. 2021, Jones and Shah 2021].

Several initiatives have been carried out to support relationships based on interpersonal trust among students in VLEs, such as student trust profiles and peer evaluation [Miguel et al. 2014], networks of friends [Deng et al. 2018, Elghomary and Bouzidi 2019, Elghomary et al. 2022] and recommendation systems [Dwivedi and Bharadwaj 2013, Deng et al. 2018, Elghomary and Bouzidi 2019].

Regarding the student's trust profile, [Miguel et al. 2014] proposed the creation of public trustworthiness profiles for students using collective peer evaluation data based on their interactions in online learning environments. These profiles help identify trustworthy students in the collective context. Another important aspect is the incorporation of social trust through friendship networks. The model proposed by [Deng et al. 2018] considers that users' decisions are influenced not only by their own preferences but also by the opinions of trusted friends. Similarly, [Elghomary and Bouzidi 2019] developed a trust-based peer recommendation system that focuses on connecting students through friendship networks to encourage collaboration. Its architecture considers attributes such as time elapsed since the last interaction, feedback, cooperation, common interests, honesty, and experiences of friends of friends. Following this same direction, [Zhang et al. 2022] proposed a recommendation model that uses past interactions between students to calculate trust levels, taking into account the quality of these interactions and individual preferences, in addition to eliminating low-trust connections. Meanwhile, [Dwivedi and Bharadwaj 2013] combined learning styles and knowledge levels with trust measures to recommend study partners. In this case, trust is estimated based on the similarity between attributes evaluated by different students.

Previous studies have focused on more limited aspects of trust among students, this work takes a more comprehensive approach, incorporating several relevant functionalities. This expansion is justified by the multifaceted and subjective nature of trust, which requires solutions that are sensitive to the variety of contexts and perceptions in VLEs.

3. Research Method

The methodology adopted in this work was structured into four main stages: (i) Elicitation of requirements; (ii) Requirements Verification; (iii) Development of a mockup with features aimed at supporting interpersonal trust; and (iv) Validation of the mockup with stakeholders.

In the first stage, the first three authors conducted the requirements gathering process, based on the characteristics that influence interpersonal trust identified in a systematic literature review [Barbosa and Maciel 2025] and on the characteristics identified by survey performed with students [Barbosa and Maciel 2024], while the last author checked for ambiguities and inconsistencies. Three artifacts were developed: a conceptual map with the classification of attributes that influence trust, a software requirements list, and an integrative conceptual model of features with their respective software requirements (see link with artifacts). In the second stage, we carried out a software requirements verification process with three software engineers that are part of our research group, with the

aim of ensuring the consistency and relevance of the proposed features. This verification involved a critical analysis of the requirements identified, seeking to eliminate ambiguity, redundancies and ensure alignment with the empirical and theoretical evidence previously gathered. As a result, the system requirements list was generated, consolidating the items validated in this stage.

In the third stage, we developed a mockup with features aimed at supporting interpersonal trust. The mockup was built based on the requirements previously verified, with the aim of visually representing how the system's features could operate in practice. This representation allowed us to explore, in a concrete way, the requirements materialization. In the fourth stage, we validated the mockup with stakeholders. The aim was to obtain feedback on the clarity, usefulness and applicability of the proposed features. The validation sought to assess both the technical aspects and the perception of end users, allowing us to identify improvements before software development.

4. TrustMatchMaker Proposed: Supporting Trust in VLEs

To translate the identified software requirements into a concrete solution, we developed a high-fidelity mockup of a plugin named TrustMatchMaker, integrated with Moodle. This prototype was designed to illustrate how trust-promoting features can be embedded into VLEs, supporting the development of interpersonal trust among students during collaborative learning. Moreover, the prototype served to gather potential users opinions before software product implementation.

The software requirements that guided the design of the prototype were grouped into features aimed at information visibility, support for choosing trustworthiness partners, encouraging interaction, recognizing positive behaviors, and promoting collaboration. These requirements formed the basis for the design of each component of the solution.

The proposed solution integrates five key components, namely: (i) Student trust profile, self declaration of students characteristics; (ii) collaborative work teams, allowing interaction and performance evaluation between members; (iii) Trusted partner, recommendation system to suggest colleagues considered trustworthy; (iv) Peer evaluation allows students themselves to provide feedback on their peers' collaboration and performance in joint activities, including through the use of a badge system, which allows students to recognize and value their peers' collaboration and trustworthiness by awarding badges; (v) the implementation of a network of friends, integrated into VLEs. Each feature in the prototype was designed based on a specific set of software requirements.

On the TrustMatchMaker login screen, access is gained through the Log in with Moodle option, which directs the user to the authentication page, where Moodle credentials are entered (figure 1(b)). The system interface has four main sections located at the bottom of the screen: recommendations, messages, notifications, and user profile, organized in a bottom navigation bar that groups related features together for ease of use.

Regarding the **Student Trust Profile**, this feature aims to reflect individual attributes that influence trustworthiness and to provide relevant information for potential collaborators. By enabling transparency, autonomy over shared information, and visibility of trust signals, this functionality supports the subjectivity, dynamism, and social prop-

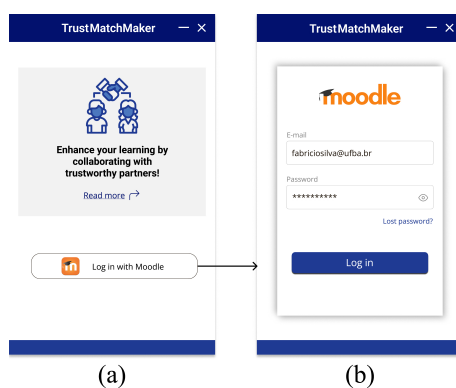


Figure 1. Login screen

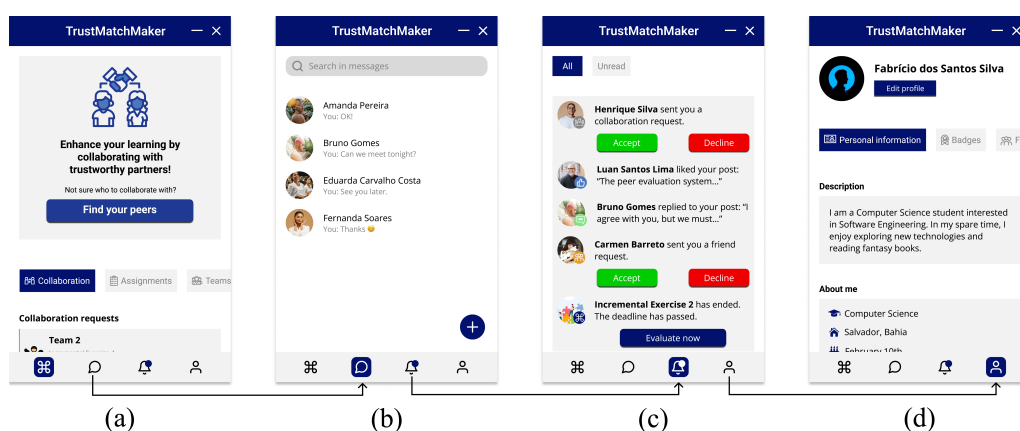


Figure 2. Screenshots of the TrustMatchMaker prototype

agation of trust in VLEs, helping students make more informed decisions when choosing peers for collaboration.

This feature is grounded in the following software requirements: (R1) Students must be able to manage a demographic profile, including areas of interest, academic background, and geographic location; (R2) The system should register trust-related attributes, such as punctuality, communication, cooperation, empathy, and responsibility; (R3) The profile should present a trust score that is automatically updated based on peer evaluations; and (R4) It should be possible to view another student's profile, including their interests, badges received, and mutual connections. These requirements are operationalized in the TrustMatchMaker prototype through a personalized profile interface, which includes (see figure 3):

- A section with basic information (e.g., name, course, profile picture, short bio, and personal interests shown as tags) (R1, figure 3a).
- A trust score, calculated from peer evaluations, that displays ratings (using stars) for attributes such as attendance, creativity, punctuality, and communication (R3, figure 3b).
- A dedicated tab for badges, where students can view recognition received for positive traits and skills (R4, figure 3c).

Regarding the feature of creating **Work teams**, the prototype includes a feature that aims to facilitate the autonomous organization of groups and promote the formation

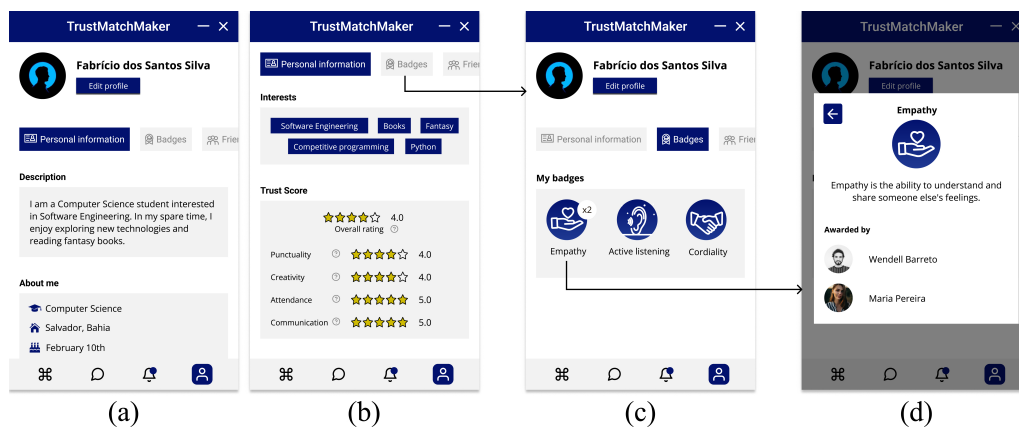


Figure 3. Student Profile

of more aligned collaborative teams. This feature was designed to provide a structured and flexible environment for building groups, respecting preferences, affinities, and previous collaboration histories among students. The feature is anchored in the following software requirements: (R5) The system must allow students to create work groups and add members to them. Each group must have a configurable delivery date, with the possibility of extension; (R6) The invited student must have the option to accept or decline participation in the group; (R7) The system must show the invited student the list of participants already in the group before they decide whether or not to accept the invitation; (R8) The system must show the student's level of compatibility with the group, considering the history of previous collaborative interactions, with emphasis on positive or negative evaluations received from current members. These requirements are operationalized in the TrustMatchMaker prototype through an intuitive flow of group creation and recommendation, which includes (see figure 4):

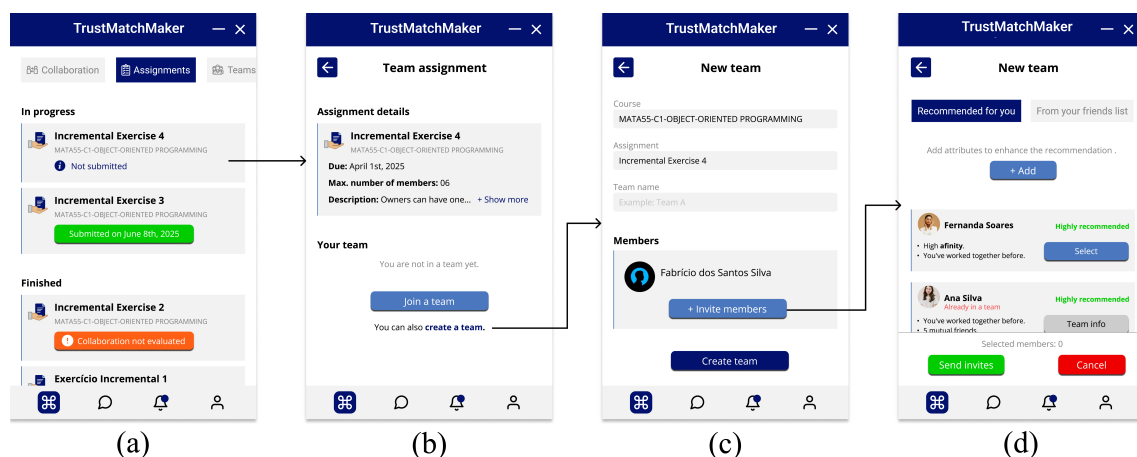


Figure 4. Creating teams for collaborative work

- A assignments panel, where students view ongoing and completed activities, with status and deadline information (R5, figure 4a).
- A assignments detail interface, with the option for the student to create or join a specific team for the selected activity (R5, figure 4b).

- A group creation form, which displays the name of the task, the corresponding subject, and allows members to be added to the group (R5, figure 4c).
- A peer recommendation mechanism, indicating the compatibility of members (highly recommended), or alerting when someone already belongs to another group. (R8, figure 4d).
- The capability to view detailed information about suggested members, including previous interactions and mutual friends, before sending invitations (R8, figure 4d).
- Buttons to send invitations or cancel the action, ensuring that the decision is always consensual and informed. (R6, figure 4d).

By allowing intentional team formation based on subjective criteria and collaborative data, this feature promotes mutual trust, history-based decision making, and the strengthening of interpersonal relationships in VLEs. In addition, when receiving invitations to join teams, the system provides valuable contextual information to support more informed decisions. This includes (see figure 5):

- Alerts about previous negative experiences with group members, based on the student's own past evaluations; (figure 5b).
- Positive highlights, such as participants with high trust scores or a good reputation among mutual friends (figure 5b,c).
- A visualization of the current team composition, with the names and trust scores of each member, as well as a summary of the overall affinity with the group (R6, figure 5c).

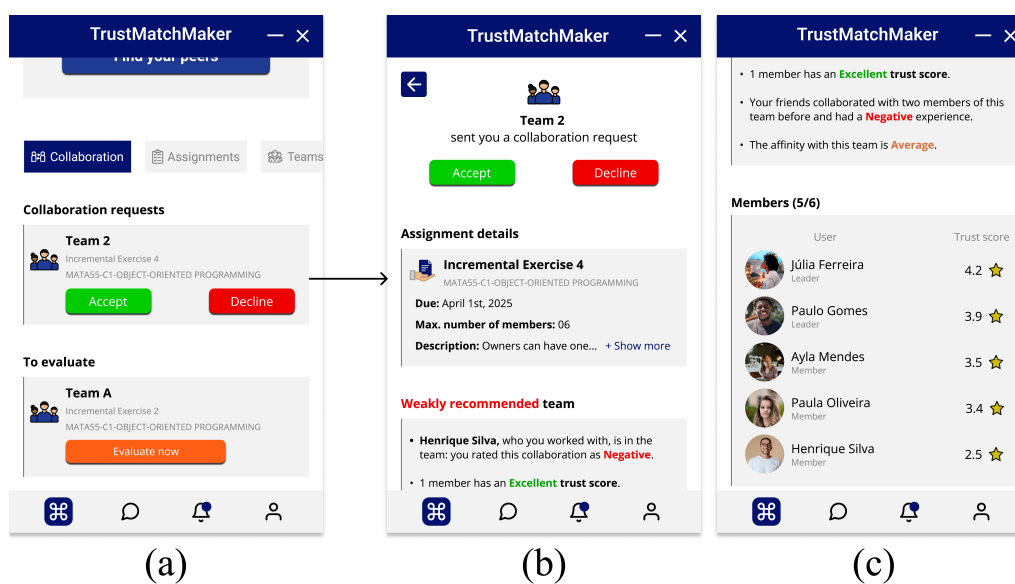


Figure 5. Invitation to collaborate

This set of features strengthens the subjective dimension of collaboration, promoting greater transparency, preventing recurring conflicts, and encouraging more trustworthiness and productive partnerships VLEs.

Regarding the **Trusted partner** feature, it aims to support the formation of more effective collaborative groups, the prototype includes a trusted partner recommendation feature designed to suggest colleagues based on signals of interpersonal trustworthiness and contextual affinity. This feature is grounded in the following software requirements:

(R9) The system must provide recommendations for colleagues based on interpersonal trust data; (R10) Students must be able to request partner recommendations for a specific activity; (R11) When there is no trust history, suggestions must consider similar demographic profiles; (R12) For students with a history, suggestions must consider the similarity between trust scores; (R13) The system should allow for the personalization of recommendations based on specific trust attributes; (R14) Suggestions may consider mutual friends and recent interactions in forums and activities; (R15) Recommendations should be accompanied by justifications accessible to the student; (R16) The student should be able to accept or decline suggestions for recommended partners. These requirements are operationalized in the TrustMatchMaker prototype through an integrated evaluation interface, consisting of (see figure 6):

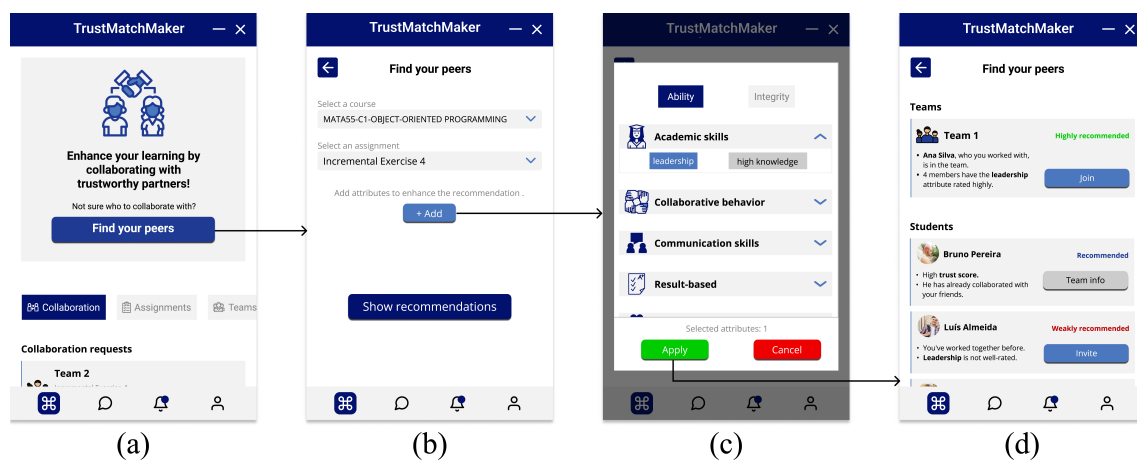


Figure 6. Recommendation system

- An area to request recommendations, linking the request to a specific course and activity with the possibility of adding a desired characteristic for recommendation (R9, R10, R11, figure 6a, 6b, 6c).
- A panel of suggested teams, highlighting groups where the student has high affinity, a positive history of collaboration, or multiple members with good scores on relevant attributes, such as leadership or responsibility (R9, figure 6d).
- Explanatory labels (e.g., “leadership” or “high trust score”) that justify the presence of each suggestion (R15, figure 6d).
- Buttons to request entry into a recommended group or view the detailed profile of suggested members (figure 6d).
- The possibility to view individual recommendations, based on interaction history, number of mutual friends, and profile affinity, as illustrated in figure 6 (R11, R12, R14, figure 6d).

Figure 7 shows the group and colleague recommendation screen, highlighting the factors that led to the recommendation (e.g., previously well-rated collaboration, strong attributes such as leadership, and multiple mutual connections). The interface allows students to browse suggestions, view detailed member profiles (such as Ana Silva), check their trust scores, and interact with them through collaboration invitations or private messages.

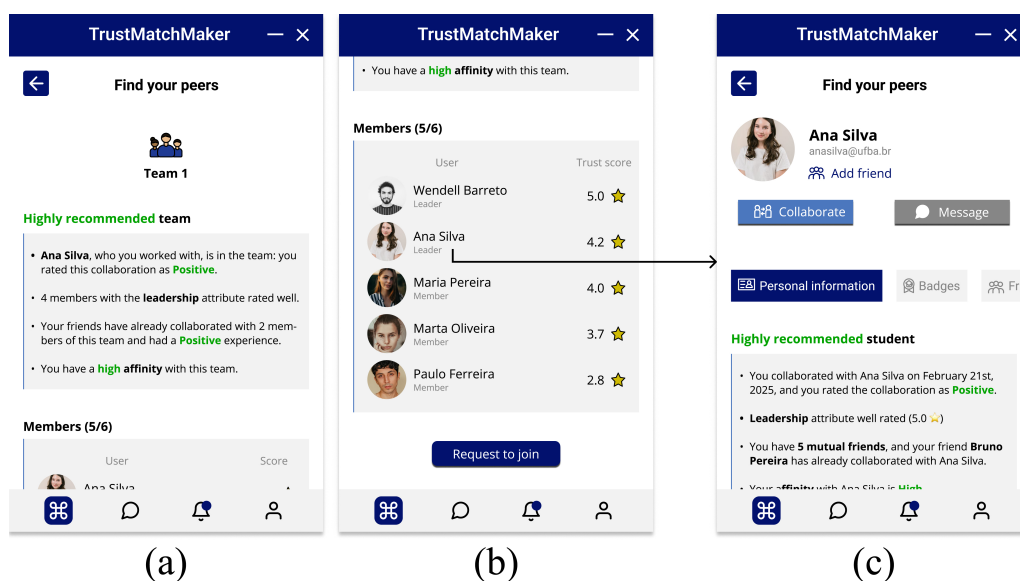


Figure 7. Recommendation of teams for collaboration

By articulating objective trust data with relational aspects and individual preferences, this feature promotes more informed decisions about who to collaborate with, encouraging more trustworthiness, diverse interactions geared toward building effective groups in VLEs.

Regarding the **Peer evaluation** feature keeps trust scores up to date through peer evaluation, allowing students to reflect on their experiences and provide feedback. By recording these interactions as a collaboration history, the system supports continuous trust updates and provides recent evidence for more secure choices of future partners. This feature is grounded in the following software requirements: (R17) The system should allow students to evaluate peers with whom they have performed group activities; (R18) Students should perform an overall evaluation of the collaboration, rating the experience as positive or negative; (R19) Students should assign scores to specific trustworthiness characteristics observed in each peer; (R20) The system should maintain a history of peer evaluations; (R21) The result of the evaluation (positive or negative) must be stored with information about the students involved and the date of the collaboration; (R22) To recognize the positive characteristics of a colleague, students can award a badge; (R23) The student must have a set of badges received, stored in their profile; These requirements are operationalized in the TrustMatchMaker prototype through an integrated evaluation interface, consisting of (see figure 8):

- Section of activities in progress and finished, where students evaluate the members of a team in which they performed collaborative activity (figure 8a).
- A screen for assigning evaluations by member, allowing for the evaluation of interpersonal skills (e.g., leadership, cooperation, and technical knowledge and commitment) using a star rating system (R17, figure 8c).
- A dedicated screen for assigning badges, where students recognize positive traits in their peers, such as empathy, cordiality, or patience (R22, R23, figure 8d).

Regarding the **Friends network** feature, it deals with the visualization and management of social connections within the virtual environment, with the aim of supporting

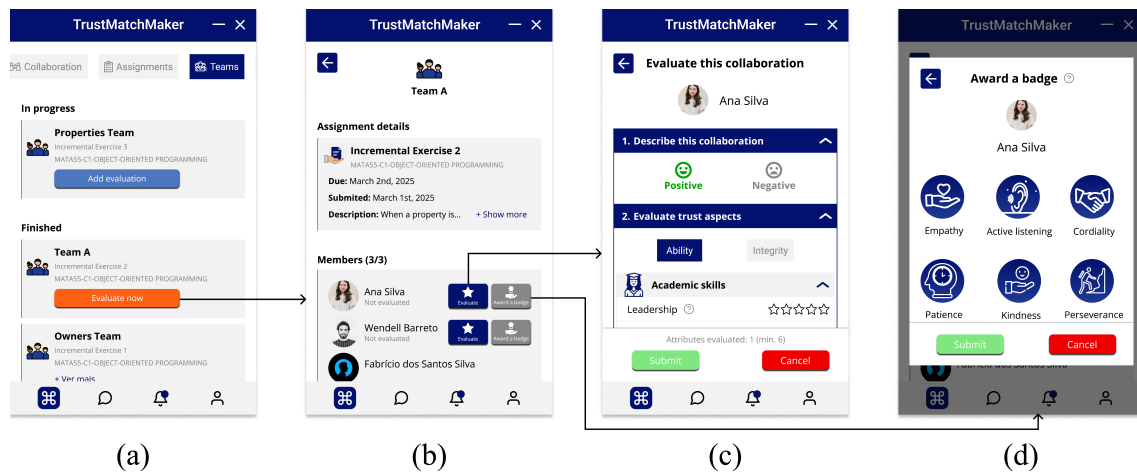


Figure 8. Peer evaluation

the construction of trusting interpersonal relationships and promoting recurring collaborations, the system implements a network of friends, allowing students to establish connections that increase their mutual trust in the virtual environment. This friendship network structure helps to consolidate a trust network, which can be used by other system features, such as recommendations for trusted partners, group suggestions, and analysis of previous collaborations. The explicit representation of mutual friends, together with navigation between connected profiles, strengthens the perception of belonging and mutual support in the collaborative environment. The following are the requirements that define this feature: (R24) The system must allow students to send and receive friend requests, creating connections between friends; (R25) The recipient of the request can accept or decline it; (R26) The system must allow students to view friends they have in common with other users. These requirements are operationalized in the TrustMatchMaker prototype through an integrated evaluation interface, consisting of (see figure 9):

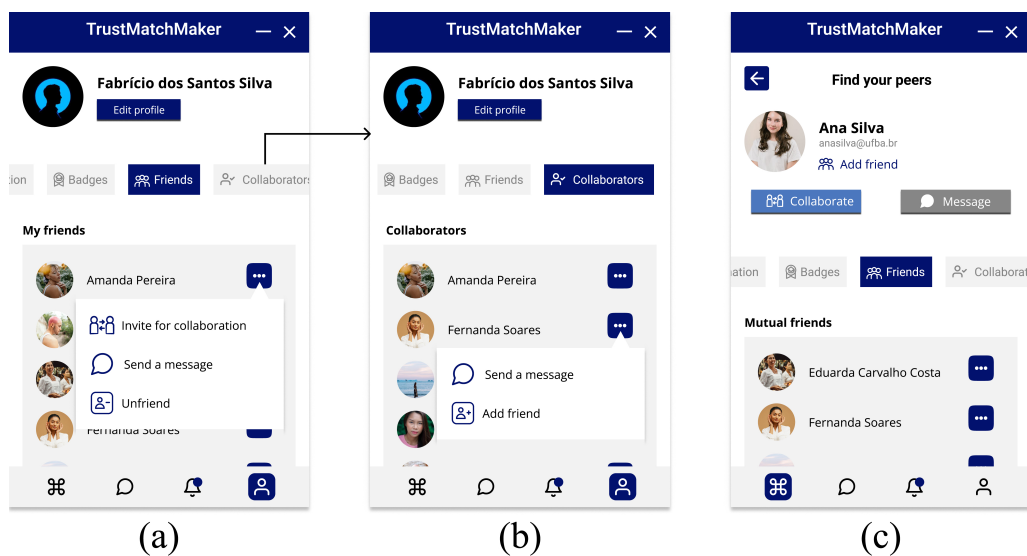


Figure 9. Friends and collaborators of the student

- Mutual friends section, which helps to increase perceived trust based on the transitivity of trust, facilitating the decision to accept friendship or collaboration (R26, figure 9c).

- Add friend button on visited profiles that are not yet part of the friend network, as shown in figure 9 (R26, figure 9b).
- Actions menu for friends already connected, such as sending messages, unfriending, or inviting to collaborate (figure 9a).
- Specific Collaborators tab, which displays colleagues with whom the student has already worked in previous activities, allowing these contacts to be added as friends and messages to be sent (figure 9b).

4.1. Validation

TrustMatchMaker was validated in two phases: (i) the first phase aimed to gather technical and usability feedback on the initial mockup, and (ii) the second focused on understanding students' perceptions and feelings regarding each proposed feature. The mockup was updated following participants' suggestions before the second phase.

In the first phase, the mockup was shown to five participants, and impressions were recorded in qualitative reports. The group included three systems development professionals, one professor with experience using VLEs, and one undergraduate student. Overall, participants considered the proposal promising, especially highlighting the integration of the friend's network with the recommendation system, acknowledging the proposal's potential, and considering the features relevant and promising for educational settings. However, they pointed out several issues: (i) inconsistencies in the flow of information, recommending a reorganization of features into more coherent groups to enhance usability; (ii) low intuitiveness in the recommendation request functionality, suggesting improvements to usability; (iii) the need for visual consistency with the Moodle environment, especially regarding icons and typography; and (iv) concerns about the exposure of the student's trust score on their profile, which might lead to discomfort or misinterpretations. The student and the professor also emphasized usability issues, particularly regarding the features' clarity and navigation.

In the second phase, five students with experience in virtual courses evaluated the prototype refined version. A structured questionnaire was used, including closed questions (Likert-scale item, 5-point scale) followed by open-ended questions for qualitative feedback. The main objective was to assess participants' perceptions and emotional responses to the system's features.

Regarding student profiles, participants acknowledged the value of accessing the information to understand their peers better. Three participants strongly agreed with this, one partially, and one neutral. Regarding the visibility of their profiles to others, four participants agreed (entirely or partially), and one was neutral. The open-ended question about displaying trust scores revealed divergent opinions. Despite moderate acceptance, especially with the use of standardized metrics such as stars, participants expressed concerns about possible biases and the possibility of updates and reassessments over time.

The peer assessment feature was well received. All students agreed fully or partially that assessments help them understand their peers. Privacy was a point of concern, as most preferred that assessments not be visible to those being assessed. Overall, students were receptive to the idea, as long as it remained objective, standardized, and fair. However, some students felt uncomfortable with the idea of being evaluated. In such cases, we suggest that evaluations remain visible only to the system, being used exclu-

sively as criteria in recommendation processes. The badge system received predominantly positive feedback, which is seen as a valuable feature to enhance engagement and collaboration. Most participants showed strong interest in recognizing positive characteristics in their colleagues, supporting the idea that this resource can encourage mutual recognition and make evaluations more humane and motivating. Open-ended responses praised the system's potential for appreciation and motivation but warned about possible downsides, such as excessive competitiveness or reinforcing meritocratic values.

The recommendation system was received positively. All students agreed that having an automated system to suggest collaboration partners would be beneficial in helping to identify compatible colleagues, especially in contexts where there are no prior connections. A key concern was transparency, as all participants wanted to know the recommendations' criteria.

Lastly, the friend's network feature was also highly rated as a facilitator in team building, fostering interactions, and promoting knowledge exchange. Three participants agreed that this could help strengthen bonds between classmates, and two were neutral. The capability to see mutual friends was unanimously considered useful in choosing partners for collaboration. In addition, three participants strongly agreed and two agreed that having friends within the system could positively influence trust among colleagues.

5. Conclusion and Future Work

In this article, we propose a technological prototype designed to support the validation of software requirements and foster interpersonal trust among students in VLEs. The mockup incorporates five main features: a student trust profile to assist in peer selection, a peer evaluation system that updates trust indicators based on collaborative experiences, a badge mechanism to recognize positive traits in colleagues, a friends network to strengthen social bonds and propagate trust, a recommendation system that suggests trustworthy peers or teams based on affinity, trust attributes, and past successful interactions. These features were derived from requirements identified in prior studies conducted by our research group.

We sought to address essential properties of interpersonal trust: its subjectivity, as it represents perceptions in the student's profile; its dynamism, through updates based on real interactions; and its propagation, through the network of friends, also supporting the transitivity of trust. The results obtained during validation reinforce the proposal's potential to support more reliable and effective collaborative practices in VLEs. Participants rated the proposed features as useful and relevant, highlighting in particular the value of peer reviews, the recommendation system, and the visibility of profile information to promote safer, more informed interactions aligned with individual preferences.

As future work, we intend to fully implement the features of TrustMatchMaker and apply it in a real-world scenario, with the goal of validating its effectiveness in supporting collaboration and building trust among students in virtual learning environments.

Ethical Considerations: The validation stage was conducted ethically, ensuring respect for participants. All participants were informed in advance about the objectives of the study and participated voluntarily. No sensitive or personally identifiable data was collected, and responses were recorded anonymously and used exclusively for academic and scientific purposes.

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References

- Almaiah, M. A., Al-Khasawneh, A., and Althunibat, A. (2020). Exploring the critical challenges and factors influencing the e-learning system usage during covid-19 pandemic. *Education and information technologies*, 25:5261–5280.
- Anwar, M. (2021). Supporting privacy, trust, and personalization in online learning. *International Journal of Artificial Intelligence in Education*, 31(4):769–783.
- Barbosa, M. P. and Maciel, R. S. P. (2024). Why should i trust you? a survey on interpersonal trust in virtual learning environments. In *Anais do XXXV Simpósio Brasileiro de Informática na Educação*, pages 1263–1278, Porto Alegre, RS, Brasil. SBC.
- Barbosa, M. P. and Maciel, R. S. P. (2025). Interpersonal trust among students in virtual learning environments: A comprehensive review. *Journal on Interactive Systems*, 16(1).
- Baturay, M. H. and Toker, S. (2019). The comparison of trust in virtual and face-to-face collaborative learning teams. *Turkish Online Journal of Distance Education*, 20(3):153–164.
- Borum, R. (2010). The science of interpersonal trust. *Randy Borum*, pages 1–79.
- 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.
- Deng, X., Li, H., and Huangfu, F. (2018). A trust-aware neural collaborative filtering for elearning recommendation. *Educational Sciences: Theory & Practice*, 18(5):2217–2234.
- Dwivedi, P. and Bharadwaj, K. K. (2013). Effective trust-aware e-learning recommender system based on learning styles and knowledge levels. *Journal of Educational Technology & Society*, 16(4):201–216.
- 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.
- Elghomary, K., Bouzidi, D., and Daoudi, N. (2019). A comparative analysis of osn and siot trust models for a trust model adapted to moocs platforms. In *Proceedings of the 2nd International Conference on Networking, Information Systems & Security*, pages 1–8.
- Elghomary, K., Bouzidi, D., and Daoudi, N. (2022). Design of a smart mooc trust model: Towards a dynamic peer recommendation to foster collaboration and learner’s engagement. *International Journal of Emerging Technologies in Learning (iJET)*, 17(05):pp. 36–56.

- Fachrunnisa, O., Hussain, F., and Chang, E. (2010). State of the art review for trust maintenance in organizations. In *2010 International Conference on Complex, Intelligent and Software Intensive Systems*, pages 574–580. IEEE.
- Feng, C. and Xu, Y. (2020). Case study of collaborative learning in a massive open online course. In *2020 Ninth International Conference of Educational Innovation through Technology (EITT)*, pages 47–51. IEEE.
- Jones, S. and Shah, P. (2021). The tangled ties of trust: A social network perspective on interpersonal trust. In *Understanding trust in organizations*, pages 205–232. Routledge.
- Kunthi, R., Wahyuni, R., Al-Hafidz, M. U., and Sensuse, D. I. (2018). Exploring antecedent factors toward knowledge sharing intention in e-learning. In *2018 IEEE Symposium on Computer Applications & Industrial Electronics (ISCAIE)*, pages 108–113. IEEE.
- Lima, M. d. S., David, J. M. N., and Maciel, R. S. P. (2024). Mudança do ensino remoto: Design instrucional experiências vividas. 32:533–567.
- 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.
- McEvily, B., Zaheer, A., and Soda, G. (2021). Network trust. In *Understanding trust in organizations*. Taylor & Francis.
- 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.
- O'Brien, B. (2002). *Online Student Retention: Can It Be Done?* Association for the Advancement of Computing in Education (AACE).
- Rotter, J. B. (1967). A new scale for the measurement of interpersonal trust. *Journal of personality*, pages 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.
- Venega, V. and Maciel, R. (2021). Requirements for development of cmooc platforms from the professional's perspective. In *Proceedings of the 32nd Brazilian Symposium on Computers in Education*, pages 80–90, Porto Alegre, RS, Brasil. SBC.
- 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.

Zhang, X., Li, M., Seng, D., Chen, X., and Chen, X. (2022). A novel precise personalized learning recommendation model regularized with trust and influence. *Scientific Programming*, 2022:1–15.

A. Appendix - TrustMatchMaker Evaluation

The evaluation and validation process of TrustMatchMaker was conducted through a questionnaire comprising both open-ended and closed-ended questions. The closed-ended questions used a 5-point Likert scale (1 – Strongly disagree, 5 – Strongly agree). The open-ended questions allowed for the exploration of participants' perceptions, suggestions, and potential criticisms, providing a deeper understanding of the proposed features and the prototype's potential to foster interpersonal trust in collaborative learning contexts.

Question	Type
1. I see benefits in viewing personal interest information of my peers, as it helps identify affinities during activities in the virtual environment.	Closed-ended
2. I see benefits in viewing information related to peers' interactions with other students.	Closed-ended
3. The information shown in the trust profile is generated from students' interactions and collaborations in group activities. These evaluations are necessary to learn about other students' characteristics.	Closed-ended
4. I feel comfortable being evaluated by my peers.	Closed-ended
5. Contributing with evaluations can help build a more collaborative environment.	Closed-ended
6. I would not feel comfortable if the student I evaluated knew my evaluation result.	Closed-ended
7. I feel comfortable having my trust profile visible to other students.	Closed-ended
8. I believe that this type of information (interactions, group work, proactivity, communication, etc.) can improve the quality of interactions among students.	Closed-ended
9. I would like to control who can see my trust profile.	Closed-ended
10. How would you feel seeing your trust score or profile? Is there anything that might bother you?	Open-ended
11. I would like to highlight the positive qualities of my peers through badges.	Closed-ended
12. The possibility of awarding badges makes the evaluation more human and motivating.	Closed-ended
13. Receiving a badge from a peer would make me feel valued.	Closed-ended
14. What do you think about having a badge-based evaluation system in the virtual environment? Does anything bother you or do you see any advantage?	Open-ended
15. I see benefits in having an automated system to suggest collaboration partners.	Closed-ended
16. The recommendation system would help me find more compatible partners to work with.	Closed-ended
17. I would like to know the criteria used for recommending peers.	Closed-ended

18. I would trust forming groups based on the system's recommendations.	Closed-ended
19. What do you think about having a system that automatically selects partners?	Open-ended
20. Having a friends network in the system helps strengthen student bonds.	Closed-ended
21. I feel comfortable having my friends list visible to other peers.	Closed-ended
22. Viewing mutual friends can help when choosing group partners.	Closed-ended
23. Having added friends in the system can positively influence trust among peers.	Closed-ended
24. What do you think about having a friends network in the virtual environment? Does anything bother you or do you see any advantage?	Open-ended