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# DikoLint: Design, communication, and interculturality in virtual learning settings – lessons learned from a subproject of virTUos

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**Abstract**

The DikoLint subproject, embedded in the STiL-funded joint project virTUos at the Technical University of Dresden, aimed at the systematic further development of Virtual Collaborative Learning (VCL) in international teaching contexts. The focus was on the didactic modeling of complex case scenarios, the intercultural qualification of student e-tutors in tandem structures, and the development of feedback and intervention indicators for proactive learning support. The project was supplemented by the integration of digital tools such as conversational agents and gamification elements. The results show a high transfer potential to other virtual, interdisciplinary, and international teaching formats, especially COIL settings. DikoLint thus makes a substantial contribution to the strategic further development of the VCL framework and supports universities in the professional, sustainable, and internationally compatible design of digital learning offerings.

Das Teilprojekt DikoLint, eingebettet in das STiL-geförderte Verbundvorhaben virTUos an der Technischen Universität Dresden, zielte auf die systematische Weiterentwicklung von Virtual Collaborative Learning (VCL) in internationalen Lehrkontexten. Im Zentrum standen die didaktische Modellierung komplexer Fallszenarien, die interkulturelle Qualifizierung studentischer E-Tutor:innen in Tandemstrukturen sowie die Entwicklung von Feedback- und Interventionsindikatoren für eine proaktive Lernbegleitung. Ergänzt wurde das Projekt durch die Integration digitaler Tools wie Conversational Agents und Gamification-Elementen. Die Ergebnisse zeigen ein hohes Transferpotenzial in andere virtuelle, interdisziplinäre und internationale Lehrformate, insbesondere COIL-Settings. DikoLint leistet damit einen substanziellen Beitrag zur strategischen Weiterentwicklung des VCL-Frameworks und unterstützt Hochschulen bei der professionellen, nachhaltigen und international anschlussfähigen Ausgestaltung digitaler Lernangebote.

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## 1. ntroduction

The increasing digitization of university teaching brings with it not only technical challenges, but above all didactic and organizational ones. Virtual collaborative learning environments (VCL) are considered forward-looking teaching formats in higher education that enable students to actively participate in learning processes across locations [1]. At the same time, they place high demands on didactic design, support from teachers, and the social and intercultural skills of participants [2].

Against this background, the subproject DikoLint (Anchoring Digital, Collaborative Learning in International Teaching at TUD) was initiated at the Technical University of Dresden as part of the STiL-funded joint project virTUos. The aim was to develop, test, and optimize systematic standards and model solutions for virtual teaching and learning settings. The focus was particularly on the further development of didactic design patterns and the development of intercultural and digital skills among student e-tutors.

In addition, the iterative development of support instruments—such as feedback indicators and digital tools—was intended to achieve a sustainable improvement in quality in virtual teaching practice. The subproject thus sees itself as a contribution to the professionalization and standardization of VCL scenarios in international contexts.

## 2. Virtual Collaborative Learning

Virtual Collaborative Learning is a learner-centered approach in higher education based on problem-oriented learning [3]. Students work together in small, often interdisciplinary groups to solve real-world case studies – usually using digital collaboration tools and in both synchronous and asynchronous phases. The aim is to promote not only technical skills, but also social, intercultural, and digital skills [4].

A VCL project typically comprises four central design elements: (1) a realistic case study with authentic tasks, (2) a suitable technical platform to support collaboration, (3) professional didactic support, e.g., by qualified e-tutors, and (4) the use of learning analytics to evaluate and control learning processes.

The groups usually consist of four to six people, with heterogeneity in terms of culture, prior knowledge, and perspectives being expressly desired in order to enable multi-perspective problem solving. Active participation by all members is encouraged through role allocation, structured tasks, and a high degree of self-organization. The combination of case work, digital cooperation, and interdisciplinary exchange specifically prepares students for complex challenges in their future professional lives [4].

Figure 1 graphically illustrates the four key components of a VCL.


*Fig. 1: Components of a VCL.*

## 3. Results from the subproject DikoLint

The DikoLint subproject has produced key results in several development cycles that have contributed to improving the quality and systematization of virtual collaborative teaching and learning scenarios. The four key components are explained in more detail below:

### *1. Subject-specific adaptable design models for case scenarios*

Based on the concept of didactic design patterns, subject-specific models were developed that enable the structured and theory-driven creation of case studies. These patterns were designed to be applicable across domains and adaptable to the respective disciplinary requirements. The patterns provide didactic guidance for the design of

realistic, complex case studies and promote collaborative problem-solving processes. They cover aspects such as degree of complexity, role distribution, task interdependencies, and requirements for communication and decision-making pro-cesses. The patterns have enabled standardization to be achieved while still allowing room for individual adaptation. The procedure for creating a case study is individual and must be adapted to the target group. The presentation by Jantos et al. (2024) [9] provides a good insight into the process.

### *2. E-tutor tandems to promote intercultural and digital skills*

A key innovation of DikoLint was the introduction of a tandem model for training student e-tutors. Two tutors – ideally with different cultural backgrounds – were assigned to each international student team. The e-tutors came from Germany, Albania, and Ukraine. These tandems worked closely together, regularly exchanged ideas about group dynamics and didactic interventions, and supported each other in their professional development. The focus was on building intercultural sensitivity, targeted reflection on diversity, and the acquisition of digital support and moderation skills. The combination of collegial consultation, peer learning, and practical application led to a significant increase in competence and contributed to the professionalization of e-tutoring practice.

### *3. Development of intervention and feedback indicators*

To ensure the quality of support in virtual scenarios, indicator-based tools were developed for e-tutors. These are designed to enable proactive support of learning processes and help to systematically determine appropriate times for interventions as well as the form and content of feedback. The indicators include criteria for assessing group communication, work progress, role assumption, and conflict management. The toolkit was tested iteratively in the project and continuously refined. It now provides a differentiated basis for didactic action in digital contexts and supports consistent and transparent support practices [8].

### *4. Integration of digital tools: conversational agents and gamification*

To promote motivation and engagement, conversational agents and gamified elements were experimentally integrated into the learning scenarios. Conversational agents were used, for example, to answer frequently asked questions or to remind users of deadlines, and were received positively for the most part, although their integration required a great deal of didactic planning. Gamification elements such as points, progress bars, or playful challenges were used in a moderate form to increase activity, especially in asynchronous phases. Experience has shown that the use of digital tools is particularly effective when they are closely linked to learning objectives and embedded in a didactically sound manner. However, the integration of technical innovations remains a dynamic area of development that requires continuous evaluation and adaptation [7].

A supplementary quantitative evaluation from the DikoLint context [5] shows that the platform functions used in virtual collaboration are widely accepted. In particular, the use of audio/video calls, file storage, and group chat functions was rated as suitable by over 94% of participants. At the same time, over 50% of students wanted more transparency with regard to assessment and formative feedback, especially in comparison with other groups. This feedback underscores the relevance of the feedback and intervention indicators developed in the project.

The use of gamification was assessed differently: while the majority of participants in the English-language module tended to reject it, their German-speaking counterparts were more open to it. These results provide important insights for the differentiated design of digital motivational elements. It also became clear that clear expectation management and transparent communication about supervisory roles, especially for e-tutors, contribute significantly to satisfaction.

In summary, it can be said that the DikoLint subproject has made a significant contribution to the further development of the VCL framework. The systematic development of didactic models, qualification through tandem

models, the introduction of structured feedback indicators, and the experimental integration of innovative tools have produced concrete models of action that not only increase the quality of digital learning processes but also promote the professionalization of those involved. Particularly noteworthy is the successful combination of didactic theory and practical implementation, which results in a highly transferable and adaptable framework.

These results substantially expand the existing VCL concept by opening up new perspectives on role understanding, supervision, digital interactions, and structural standardization. Especially in international contexts, they offer starting points for not only enabling virtual collaboration, but also for designing it in a didactically sound and sustainable manner.

These findings form the basis for the transferability of the approaches developed in the project to other contexts and formats, as outlined in the following section.

## 4. Transferability of results

The concepts, methods, and tools developed in the DikoLint subproject can be transferred to a large extent to other virtual collaborative teaching contexts. This applies in particular to Collaborative Online International Learning (COIL) formats, but also to other international or interdisciplinary online teaching and learning scenarios. The modularity of the developed building blocks and their orientation toward generic didactic principles enable flexible adaptation to different institutional, cultural, and curricular conditions.

Particularly noteworthy are:

- **Didactical Design Patterns:** These enable the systematic design of case studies in different disciplines. Their openness to different thematic focuses and their structuring character support rapid and high-quality implementation, even in new contexts.
- **Tandem qualification of e-tutors:** The combination of intercultural and digital competence development in a peer learning approach is not only innovative but also scalable. The tandem approach can be easily transferred to new languages, subject cultures, and organizational forms.
- **Feedback and intervention indicators:** These provide a sound basis for quality assurance in support services. They enable e-tutors to take data-driven, reflective, and adaptive action in very different contexts.

Furthermore, the experience gained in the project shows that transferability applies not only at the methodological level, but also at the structural and organizational levels. For example, role distributions, process structures, or qualification concepts for tutors can serve as blueprints for other universities or international partner projects.

Through the targeted combination of theoretically sound and practically proven elements, DikoLint contributes to the scalability and internationalizability of VCL formats. The models developed enable the sustainable, quality- and inclusion-oriented further development of digital learning environments and make an important contribution to the future viability of higher education in globally networked contexts.

## 5. Lessons Learned

The analysis of the DikoLint project has shown that key success factors for virtual collaborative learning settings can be clearly identified and are effective across different contexts. In particular, continuous support from qualified e-tutors, clear didactic structuring via design patterns, and sensitive handling of cultural diversity have proven to be crucial for successful international collaboration.

In the course of the project, it became clear that purely technical solutions alone are not sufficient to enable sustainable learning. Rather, it depends on didactic embedding, clear communication structures, and transparent role distribution. Iterative reflection on group dynamic processes, supported by defined feedback and intervention indicators, has established itself as an effective means of quality assurance.

It also became apparent that the combination of innovation (e.g., through the use of

conversational agents) and proven pedagogical principles (such as the promotion of self-organization and personal responsibility) forms a viable basis for sustainable teaching formats. The findings from DikoLint thus not only provide practical knowledge for the further development of the VCL framework, but also strategic impetus for universities that want to expand their international teaching offerings in a didactically sound manner.

## 6. Conclusion

The DikoLint subproject has made an important contribution to the strategic development of virtual collaborative teaching formats as part of the virTUos joint project. The aim was to develop didactically sound, interculturally compatible, and technologically viable models for international university teaching – and this goal was achieved in key areas.

In particular, the combination of scientifically sound design principles with concrete, tried-and-tested methods represents real added value. The developed didactic design patterns, the tandem model for e-tutors, indicator-based feedback systems, and the reflective use of digital innovations such as conversational agents provide a whole repertoire of tried-and-tested measures. These building blocks not only strengthen the quality of individual courses, but also offer universities a structured orientation framework for the long-term integration of VCL formats.

It is particularly noteworthy that DikoLint is not only a further development of existing formats, but also provides new impetus for international digital teaching. The project shows that VCL should be understood not only as a methodological tool, but also as a strategic element of internationalization and digitization in higher education teaching.

Thanks to the transferability of the concepts developed, DikoLint can also have an impact beyond the specific project framework. Universities working on the qu ality, scalability, and sustainability of their virtual and international teaching offerings will find a wide range of starting points here. The Didactical Design Patterns can be used for this purpose [6].

Overall, the project confirms that the combination of good didactic design, intercultural sensitivity, and targeted use of technology is the key to successful virtual cooperation formats. DikoLint provides a consistent, practical, and connectable model that contributes to the further development of the VCL framework and provides universities with long-term support on their way to sustainable, international teaching practices. DikoLint offers valuable experience and clearly structured approaches that enable the sustainable further develop-ment of virtual and intercultural learning contexts. Its clear transferability and proven success factors, such as design patterns, tandem qualification, and proactive communication, make the project a source of inspiration for future virtual collaboration projects.

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