Odense, 20th Feb. 2025

Evaluation of MYRE DE-DK

Content

Introduction

The University of Southern Denmark (SDU) contributed to the MYRE DE-DK project by providing technological expertise and ensuring the quality of the didactic processes. The development og teaching modules was closely monitored, with ongoing professional feedback provided to participants. At the same time, a critical distance was maintained to enable research-based conclusions on the broader application of emerging technologies in education.

SDU's evaluation aimed to contribute both during and after the project by providing a research perspective on the teaching practices. The objective was to identify and communicate the potential benefits and challenges in the didactic, pedagogical, and organizational aspects of the project.

The following points from the evaluation are based on 13 teaching modules, all centered around the use of Emerging Technologies (ET) in education. These modules were selected as they collectively represent the diversity of the participating educational institutions, covering different levels of education, a variety of course topics, and the application of various technologies. The

Metaverse and artificial intelligence (AI) were particularly significant in shaping the project's direction.

The evaluation was conducted using the ROBOdidactics model (version 2.0, 2023), alongside observations from tech workshops, network meetings, and selected teaching sessions.

Key aspects of the evaluation include considerations of the modules' a) teaching design, b) digital production, c) digital literacy, and d) interaction with external contexts.

The evaluation also includes broader reflections on:

- How to make teaching processes transparent enough for further development.
- Fostering exchange and mutual inspiration, such as:
  - Developing avatars tailored to German students' curiosity about the Danish education system and its students ("AI-tools," "Berlin").
  - Creating scalable modules across programs (e.g., "Girls' Day").
  - The SIMAC Tech Workshop's influence on the purchase of underwater drones at RBZ Kiel (tests in autumn 2024) and smaller drones for "Science Days" (September 27th).
  - Initiating a student exchange in the German subject area for autumn 2025.
- Discussing didactic principles and the ROBO didactics model in research contexts (e.g., Berlin, Science Day).

Quality of the 13 teaching modules

The following was evaluated about the courses in relation to the 4 dimensions of the ROBO didactics model, which are linked to the specific teaching modules in detail. Most of the teaching modules were strong in all four dimensions. To be evaluated: https://gdlt.sdu.dk/teaching-modules/

The teaching modules highlight students' learning and progression. For each module, students create digital learning products, helping them adapt more effectively to emerging technologies. These hands-on experiences offer valuable insights into the advantages and disadvantages of the technologies explored.

Many modules incorporate elements related to the Sustainable Development Goals (SDGs) for example DK HTX Svendborg & Haahrs "Electric go-karts and Kinematics" and DE gym "With robotics on mission to Mars". This is potentially raising teachers' and students´ awareness of the diverse aspects of the SDGs.

The cross cultural aspects were addressed in for example the following modules DK HHX Svendborg/DE RBZ Kiel "Across borders: digital learning", Infostand Berlin and DK HHX Svendborg "ChatGPT in the subject German language".

TEACHING DESIGN

In the context of TEACHING DESIGN, the emphasis was placed on students engaging with emerging technologies like robots, AI, and XR for the creation of their learning projects or to explore technology-related subjects. These technologies were consistently integrated with the learning objectives across different subjects. Examples include:

1. DE gym "With robotics on mission to Mars" & learning videos. Students participated in building and programming robots, simulating a Mars mission scenario. Additionally, they documented and reinforced their learning by producing educational videos detailing their experiences and knowledge.
2. DK HTX Svendborg & Haahrs "Electric go-karts and Kinematics". This module fostered collaboration between HTX students and a 5th-grade class. Students operated electric go-karts and calculated distance, speed, and acceleration. To enhance the mathematical learning process, a digital logger was used. HTX students also practiced explaining academic concepts effectively during interactions with the younger students.
3. DK SDU "Semester projects with XR". Students engaged in semester projects that involved developing XR (Extended Reality) prototypes using Unity.

DIGITAL PRODUKTION

During the DIGITAL PRODUCTION phase, a variety of new technologies were explored and utilized, including commercial tools like Unity, LEGO Mindstorms EV3, and video recording and editing software. Additionally, several AI tools were incorporated, such as the avatar generator HeyGen, the translation tool RaskAI, and ChatGPT. Both teachers and students gained valuable and practical insights into the application of educational technology. Open and experimental approaches were combined with instructional design methods. Notable examples include:

1. DK HTX: "VR glasses in biology lessons" The students collaborated in groups of 3-4 to explore the human body virtually. The VR application was mirrored onto a screen, allowing those outside VR to guide the student immersed in the experience. This setup fostered teamwork and deepened their understanding of human anatomy.
2. DK HHX Svendborg "AI-supported tools for marketing" Students were tasked with understanding key principles of AI software, applying AI tools, and addressing the ethical considerations involved in using such tools. Additionally, they used HeyGen to create personalized avatars for presenting business topics.
3. DE gym "With robotics on mission to Mars" & learning videos. Students learned to build and program robots, simulating a Mars mission scenario. They were also required to document and consolidate their new knowledge through video productions that captured what they had learned.
4. DK SDU "Semester projects with XR". Students developed XR prototypes using Unity as part of their semester projects. During the ideation phase, they participated in two workshops spanning different education levels. One workshop focused on the application of XR in health education, while the other explored using VR for vocational education choices. Students who opted for the vocational education project tested their prototypes on primary school students facing educational pathway decisions.

DIGITAL LITERACY

From a digital literacy perspective, the AI cases provided a glimpse into the future and highlighted AI's role across various subjects. Working with AI enhanced students' understanding of the capabilities and limitations of educational technology and raised ethical awareness regarding generative AI. Key perspectives explored included Domain, Transparency, Governance and erosion, see table below:

Table 1. The four key perspectives on digital literacy in AI.

Perspective	About
Domain	Examining where it is morally appropriate to use AI. Is using AI as a learning companion for school assignments appropriate? Both teachers and students share concerns about its proper use in educational settings. Is it justified for use in primary schools or among vulnerable groups who may depend on AI for companionship?
Transparency	Generative AI operates as a "black box," where users see only input and output, not the decision-making process. ChatGPT, for instance, prioritizes fast, accommodating responses over factual accuracy, drawing from diverse and variable-quality internet sources.
Governance	AI Companies protect their commercial interests, often limiting transparency about data sources and user interaction storage. Educational institutions must prioritize IT security and data integrity.
Erosion	The advent of computers, calculators, and GPS has sparked debates about the decline in human skills. Have tools like GPS made us less capable of navigating with a map and compass? Similarly, could generative AI lead to a loss of essential skills as we rely on it for routine tasks? Will using tools like ChatGPT make us lazy and diminish our ability to handle writing and creative tasks independently?

These questions were discussed in network meetings and AI teaching modules. Below are a few examples:

1. DK HHX Svendborg "AI-supported tools for marketing" Students learned to design AI avatars for marketing purposes while also considering the related ethical implications.
2. DK HHX Svendborg "ChatGPT in the subject German language". Students used ChatGPT to identify and correct grammatical errors in their German assignments. This allowed them to test the tool in class, with teachers evaluating the results, and prompted reflection on the ethical issues surrounding generative AI. This was one of the courses which managed to contain elements from the other country´s culture, methods, language or other specific characteristics.
3. DK HHX Svendborg & Haahrs "AI-support of business development" 11 students from grade 13 (3. g, HHX) have collaborated and supervised 50 students at grade 10 from Haahrs. The goal was to apply business-related Ai-tools, and consider ethical issues when using this kind of AI-tools. The AI tools were offed by the HHX.

OUTSIDE WORLD – ENVIRONMENT

The involvement of external stakeholders enriched the processes through cases and discussions. This broadened and systematized learning across the educational chain, fostering greater mutual understanding and method exchange among teachers across different education levels. Surprisingly, most of the teaching modules had supported career learning. Below are a few examples:

1. DK SDU & UCL "XR in Health Education". UCL conducted a workshop showcasing and testing XR applications for procedural training. This experience was an eye-opener for the engineering students, revealing the extensive use of XR in health education.

2. DE RBZ Kiel & Fachhochschule Kiel "AR-illustrated posters: renewable energies" Emphasize the educational chain by fostering collaboration between an engineering student and business informatics students on green energy initiatives.

3. DK SDU "Semester projects with XR". The students created XR prototypes in Unity as part of their semester projects. During the ideation phase, they attended two workshops within the educational chain: one focused on XR in health education and the other on using VR to aid vocational education choices. Those who opted for the vocational education project tested their prototypes with primary school students making educational pathway decisions.

4. DK HTX Svendborg & Haahrs "Electric go-karts and Kinematics". The module facilitated bridging activities between HTX students and a 5th-grade class. It involved driving electric go-karts and calculation of distance, speed, and acceleration, supported by a digital logger for mathematical accuracy. HTX students also practiced conveying academic concepts effectively while communicating with the younger students.

5. DE RBZ Kiel & Gemeinschaftsschule "Girls' Day with Robotics". This module built on the success of the Mars mission module, requiring RBZ students to present their findings during the "Girls Day" bridge-building activity.

6. DK HHX Svendborg & SDU "Enjoy your exam!" VR & 360 degree cam. The goal was to prepare students for exams. The project was completed on paper but was not implemented digitally.

7. DK HHX Svendborg/DE RBZ Kiel, Infostand Berlin. The module originated from initial cross-national discussions between Danish and German MYRE teachers, developed as a collaborative effort involving 2 Danish students and 4 German students, all young women. This module initiated the collaboration between HHX and RBZ.

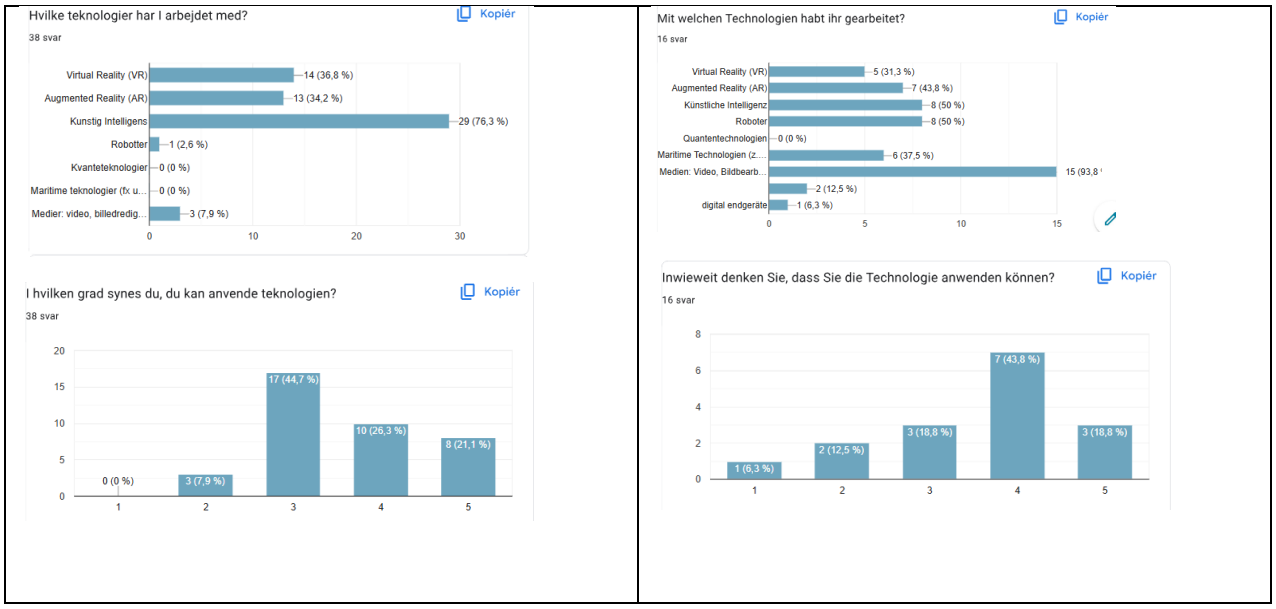
8. DK HHX Svendborg & Haahrs "AI-support of business development" 11 students from grade 13 (3. g, HHX) have collaborated and supervised 50 students at grade 10 from Haahrs. The goal was to apply business-related Ai-tools, and consider ethical issues when using this kind of AI-tools. The AI tools were offed by the HHX.

Students´ learning

The students completed an online questionnaire at the end of the teaching modules. The survey focused on learning processes and emerging technologies. Some teachers conducted evaluations using their own methods.

The table below illustrates the various technologies utilized in the learning modules. It also indicates that most students, both Danish and German, felt comfortable using emerging technologies such as VR, AI, and robotics.

Table 2: Overview of the applied technologies and the ease with which students use them



Here is the merged summary of responses to the reflection question: "What considerations do you have regarding the use of technology?", combining perspectives from both the Danish and German data:

- Reflections on simulation & Learning: Many of the students saw the applied technology as tools for simulating Mars missions, learning programming, and improving engineering and problem-solving skills.
- Reflections on Ethics: Regarding AI, many of the students had considerations about data privacy, security, and the ethical implications of AI and emerging technologies. They were also skeptic about the accuracy and potential biases of AI-driven tools like ChatGPT.
- Reflections on future role: Many students believed that robots, AI and XR technologies will play an increasingly important role in society and industry in the future. The students had considerations about how technology might replace or change job roles in the future. They also had questions about how well the technology functions in practice and whether it genuinely improves learning or work efficiency. Concerns about how easy it will be to learn and integrate the technology into daily tasks.

Examples of students learning products are illustrated as part of the learning modules e.g. Extract from a student´s learning video https://gdlt.sdu.dk/mars-mission/ or recorded student´s exploration of virtual human body https://gdlt.sdu.dk/dk-htx-vr-glasses-in-biology-lessons/

Transfer and recycling: How became teaching modules so transparent that they could be further developed?

All teaching modules were aligned with the four fundamental perspectives of the ROBOdidactics model: teaching design, digital production, digital education, and environment (the surrounding world). These detailed descriptions provided transparency and deeper insight into each other's processes. During network meetings, teaching modules were presented with hands-on demonstrations of the specific technologies, discussed in-depth, and participants took ideas back to their own educational institutions. Several modules inspired teachers to adopt new approaches in their teaching practices.

Teachers worked with the technologies in alignment with the learning objectives. A crucial success criterion for developing the teaching modules was ensuring that the chosen technology was relevant to the learning goals. Teachers discussed this during workshops and seminars. If a technology could not be meaningfully integrated, the plan was adjusted or sometimes canceled. For instance, HHX found robots unsuitable for their curriculum but successfully used AI for marketing product development.

At each network meeting and workshop, new AI-based teaching modules were introduced, and challenges related to incorporating AI in education were discussed, such as GDPR compliance, exam management, and examples of cheating. Generative AI was a major focus for all participating institutions, and it was valuable to hear how others addressed these emerging issues. Discussions centered on how to use AI responsibly in teaching. Institutions were still in an exploratory phase with this technology. RBZ, in particular, was very concerned about GDPR and the integrity of their students.

Fostering exchange and mutual inspiration

The infostand Berlin (“Across Borders: Digital Learning”) was launched through a close collaboration between RBZ and HHX. The module was born out of initial cross-national discussions between Danish and German MYRE teachers and developed collaboratively with the participation of 2 Danish students and 4 German students, all of whom were young women.

Danish HHX students created avatars designed for German students who were curious about the Danish education system and student life ("AI-tools," "Berlin"). The influence of the SIMAC Tech Workshop led to RBZ Kiel acquiring underwater drones for testing in autumn 2024 and smaller drones for "Science Days" on September 27th.

This strengthened relationship also paved the way for a planned student exchange in the German subject area set for autumn 2025 and application for a new bilateral funding application. It takes a bit more effort to work across boarders than locally. So, in the follow-up project, more focus will be on kickstarting the bilateral transnational collaboration.

Network and new version of the didactic model

At network meetings, workshops and events hosted by all network participants, teaching modules based on the ROBOdidactics model were presented. These modules were showcased both during the development phase and in the evaluation phase after the teaching sessions had been completed. This gave educators the opportunity to delve into the “engine room” of other educators, exploring both their academic and didactic approaches. These network meetings contributed to building local capacity across the local educational chain.

The ROBOdidactics model was further developed into the new DigiDidactics model during a dedicated workshop at RBZ. Feedback on the old model highlighted that it was too detailed and not entirely intuitive for some users. During the workshop, ideas were shared on how to improve the model, with particular attention given to emphasizing the unique aspects of digital literacy and digital production, which are central to the model. This led to a revised version of the model that better underscored these distinctive features. The process behind I described here: https://gdlt.sdu.dk/the-process-behind-digidactics/

In addition to these distinctive features, the model’s emphasis on looking outward—towards the educational chain and the surrounding world—is seen as essential when working with young people transitioning into further education or the workforce.

However, the new version of the model remains overly detailed, despite efforts to simplify it. In upcoming projects, further work will be done to streamline and simplify the model.

Further reading: https://gdlt.sdu.dk/MYRE-didactics/

Teachers' competencies in practice

Results from an online survey

Both at the beginning and at the conclusion of the project, teachers completed a survey where they were asked whether they had used emerging technologies in their teaching during the project period.

However, when sorting the answers, it showed that this data was more confusing or misleading than usable. As the data were anonymous, it was not possible to track the results to newly joint, peripherical attained or fully involved teachers. Furthermore, one of the core strengths of MYRE DK-DE was its diversity and its regards to local circumstances. This diversity could not be reflected in a survey measuring quantitatively summarizing results.

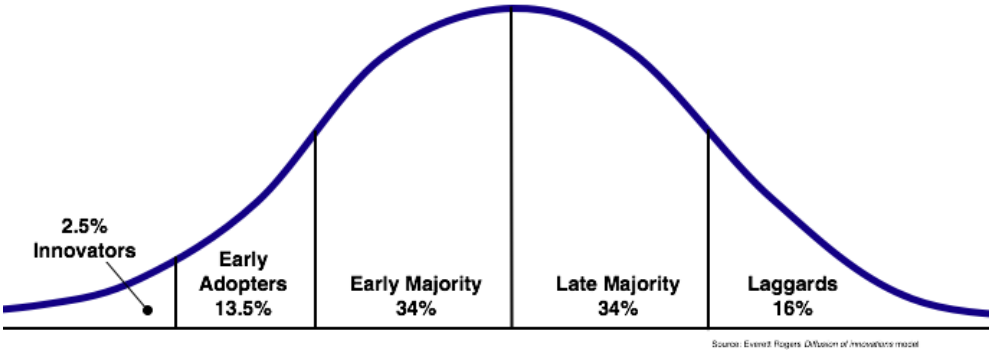
Nevertheless, a few qualitative statements came up from those teachers who had applied the ROBOdidactics model in their teaching. One teacher explained that the model serves as a good framework for sharing best-practice stories about using emerging technologies in teaching.

Another lecturer shared the following insight: "I've gained new perspectives on integrating technology into teaching, particularly how AI tools like ChatGPT can enhance student learning by supporting language correction, fostering critical thinking, and improving digital literacy." Others mentioned that the didactic model helped them "think critically about my methods and learning content."

Seen in retrospect, a qualitative focus group interview would have been beneficial for diving into learnings earnt by the teachers.

Observations and considerations
As a substitute, retrospective reflections were made and shared within the steering group. These included evaluator observations and discussions within project management, which led to insights regarding teachers' empowerment—technological, pedagogical, and personal.

These insights were related to Rogers' innovation curve, 1962, (illustration 1).



In both countries, the leading teaching forces could be described as "early adopters" or even "innovators" within their own schools.

These teachers eagerly embraced new technologies, each in relation to their respective subjects and educational programs. Consequently, the project served as a framework for exploring ways to integrate emerging technologies into didactics.

Among the Danish business high school teachers, AI was the most pressing topic. Business teachers saw great potential for AI in the commercial sector while also having to manage the fact that students were already using these tools—sometimes in less than optimal ways.

Among German teachers and lecturers from the SDU, as well as the technical high school Svendborg, robotics and XR technologies were particularly embraced, as they aligned well with the involved STEM subjects. This also presented an opportunity to modernize these disciplines and appeal to new types of students, especially girls and younger students.

By exchanging ideas in a structured manner based on the ROBOdidactics model, teachers gradually recognized and acknowledged the efforts of their colleagues across the border, despite significant differences in their approaches.

This mutual recognition was facilitated by:

- A concrete collaboration on a comprehensive teaching module (”Across borders: digital learning”, spring 2024)
- A project framework that emphasized trust and respect
- A shared pedagogical approach that centered on the student as a digital producer

In this context, SDU and project management emphasized that failure was not only permissible but perhaps even desirable in order to explore new avenues:

"Of course, we need to be cautious. But we also operate in a gray area. We cannot wait for everything to be mapped out and for new regulations to be issued. The development is happening too fast. In this way, we are actively shaping the future ourselves."

Over time, the core group of innovative teachers expanded, as successful and impactful teaching modules were presented in the schools involved. Interim evaluations and publications have reinforced the quality of these modules, while fostering the teachers´ local ownership and pride.

A steadily growing interest
More and more teachers and lecturers participated in the project's network meetings, workshops, and final events. Consequently, newly involved teachers expressed interest in joining the follow-up project, MYREcross. These new educators can be categorized as "early majority" (Rogers).

However, broader teaching staff was also increasingly involved through strategic initiatives led by the schools´ managements. For instance, HHX Svendborg has launched a strategic AI-initiative for all teachers, while RBZ Wirtschaft Kiel has begun cross-departmental collaboration between the business high school and the vocational education programs.

An agile mindset
It has clearly been accepted by the participants that genuine collaboration involves an open-minded approach to both giving and receiving inspiration from one another. This approach is rooted in a willingness to understand and respect each other’s professionalism and choices.

During MYRE DK-DE, the partners became open to questioning their own approaches and adopting insights from one another. As a result, the exchange shifted from advocating for individual or local methods to collectively searching for even better solutions. This also involved seizing new impulses and initiating activities based on learnings that emerged during the project.

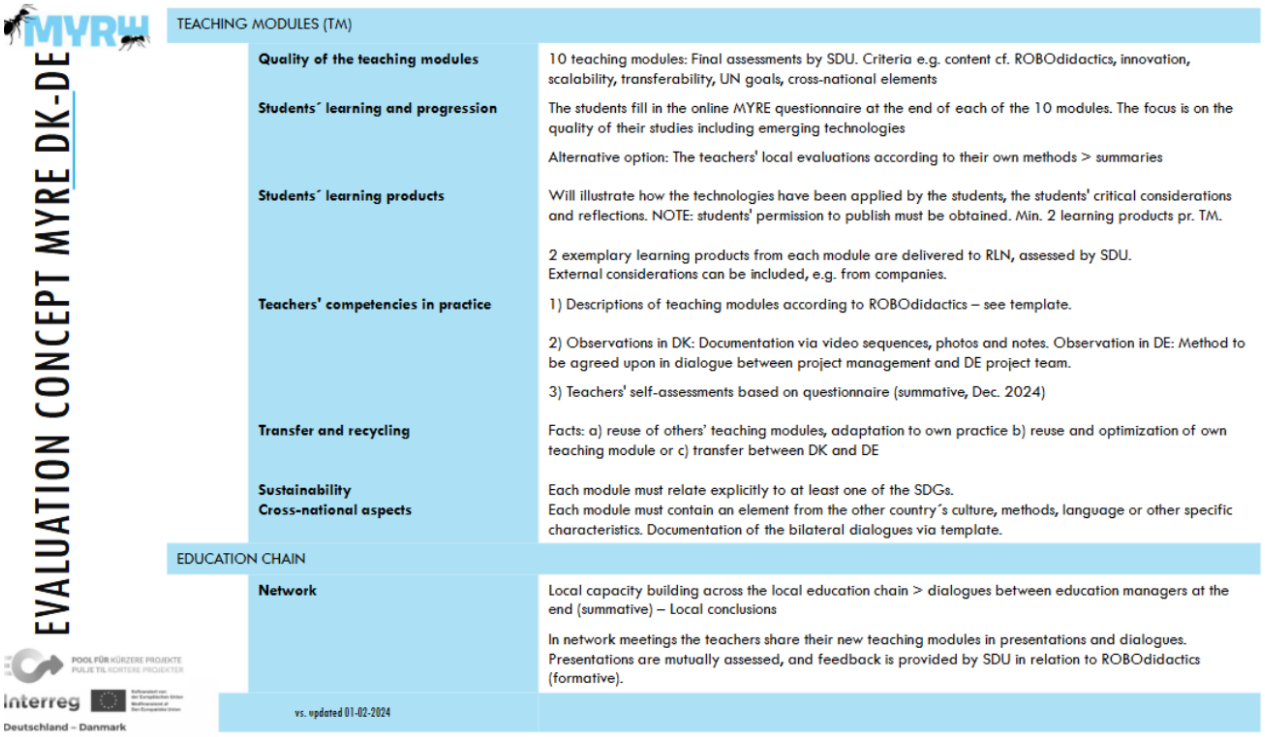
New horizons to explore
Facing worldwide challenges and the great uncertainty they bring, all partners became increasingly aware that action on these megatrends cannot be taken alone.

Actionable, flexible, and trust-based networks can help equip educational institutions and their teachers with the necessary knowledge, skills, and competencies proactively.

Thus, all partners will continue their work with emerging technologies within their local education networks and across the country border.

Appendix

Overview of evaluation framework (SDU, January 2024)



EVALUATION CONCEPT MYRE DK-DE

TEACHING MODULES (TM)	
Quality of the teaching modules	10 teaching modules: Final assessments by SDU. Criteria e.g. content cf. ROBOdidactics, innovation, scalability, transferability, UN goals, cross-national elements
Students´ learning and progression	The students fill in the online MYRE questionnaire at the end of each of the 10 modules. The focus is on the quality of their studies including emerging technologies Alternative option: The teachers' local evaluations according to their own methods > summaries
Students´ learning products	Will illustrate how the technologies have been applied by the students, the students' critical considerations and reflections. NOTE: students' permission to publish must be obtained. Min. 2 learning products pr. TM. 2 exemplary learning products from each module are delivered to RLN, assessed by SDU. External considerations can be included, e.g. from companies.
Teachers' competencies in practice	1) Descriptions of teaching modules according to ROBOdidactics – see template. 2) Observations in DK: Documentation via video sequences, photos and notes. Observation in DE: Method to be agreed upon in dialogue between project management and DE project team. 3) Teachers' self-assessments based on questionnaire (summative, Dec. 2024)
Transfer and recycling	Facts: a) reuse of others' teaching modules, adaptation to own practice b) reuse and optimization of own teaching module or c) transfer between DK and DE
Sustainability **Cross-national aspects**	Each module must relate explicitly to at least one of the SDGs. Each module must contain an element from the other country´s culture, methods, language or other specific characteristics. Documentation of the bilateral dialogues via template.
EDUCATION CHAIN	
Network	Local capacity building across the local education chain > dialogues between education managers at the end (summative) – Local conclusions In network meetings the teachers share their new teaching modules in presentations and dialogues. Presentations are mutually assessed, and feedback is provided by SDU in relation to ROBOdidactics (formative).
vs. updated 01-02-2024	

https://trello.com/b/ztGDztqg/MYRE-dk-de-evaluations