



Challenge-based Learning with Virtual Assistants

Webinar – Wednesday, 11 September 2024 15:00 - 18:00 CET
Fachhochschule des Mittelstands (FHM) Bielefeld

Welcome!

blend of theory
and practice

challenge-based
learning



insights into
the design principles

virtual
assistants

Challenge-based Learning with Virtual Assistants

sprint
workshop

Let's
discuss!

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Challenge based Learning with Virtual Assitants.



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Challenge based Learning with Virtual Assitants.

- 15:00 Welcome and ASSISTANT presentation (Prof. Jochen Dickel)
- 15:20 Virtual Assistants in Challenge-Based Learning (Prof. Jochen Dickel)
- 15:40 Agile Work Challenges in Vocational Training for Experience-Based Skill Development
(StD. Philipp Schulte, Carl-Severing Vocational College, Bielefeld)
- 16:00 Coffee Break
- 16:15 Prof. Dr. Stefan Bieletzke, CEO of Trainings Online Gesellschaft mbH who will present his AI-based virtual assistant SMARTA, designed specifically for educational purposes.
- 16:45 Sprint workshop: Conceptualizing a chatbot for a challenge-based scenario (Prof. Jochen Dickel)
- 17:15 Presentation of student challenges
- 17:30 Discussion. Valorization of ASSISTANT results
(Mag. Olga Zubikova, Research Coordinator for Digital Education, FHM)
- 18:00 Closing remarks. End of the event

Projekt Team ASSISTANT | 10.2022 – 09.2024



<https://www.assistant-erasmus.eu>



<https://www.facebook.com/AssistantErasmus>



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Objectives


- to improve learners' experience on digital transformation settings supported with chatbots.
- to increase teachers competences on chatbots design and development for learning curricular
- to increased digital transformation skills and competences
- to increase HE and Business collaboration in education by integrating CBL scenarios into curricular.
- to increase of using intelligence technologies in education by developing virtual assistants.

Three Guiding Questions:


- 1** What skills do young learners need to better face current and future digital transformation challenges?
- 2** How can we support students to develop key competences for digital transformation through challenge-based learning settings?
- 3** How can we use ai-chatbots as personal learning assistants to help students through challenging learning scenarios?

Main Objective: **Challenge based Learning in AI Enhanced Digitale Transformation Curricular.**

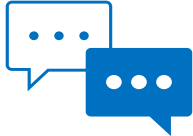
Key Results

- 

1 What skills do young learners need to better face current and future digital transformation challenges?

Digital Transformation Curriculum
- 

2 How can we support students to develop key competences for digital transformation through challenge-based learning settings?

Challenge based Learning (CBL) Scenarios
- 

3 How can we use chatbots as personal learning assistants to help students through challenging learning scenarios?

Virtual Assistant Chatbot for CBL Support

Digital Transformation Curriculum



1. Digital Education



2. Big Data & Data Analysis



3. Artificial Intelligence (AI)



4. Robotics & Internet of Things (IoT)



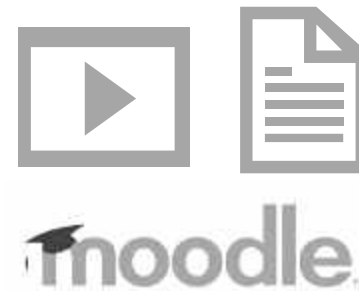
<https://www.assistant-erasmus.eu>

Digital Transformation Curriculum



Course 4: Robotics & Internet of Things

1. Introduction to IoT and Robotic
2. Application fields of IoT and Robotics
3. Functionality of IoT and Robotics
4. Development of IoT and Robotics
5. Challenge Option 1: *Healthbot*
6. Challenge Option 2: *Farmingbot*



Online Video Lectures
Lecture Slides
Additional Scripts
Chatbot
Moodle as LMS Platform
40 hours workload
3 months duration

Jochen Dickel



Virtual
Assistants
in Challenge-
Based Learning

Challenge-based Learning with Virtual Assistants

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Challenge-Based Learning (CBL)



Challenge-Based Learning (CBL)



Constructivist Theories:

- Roots in John Dewey in 1920s and Jean Piaget in 1950/60s
- Emphasizes active learning through experience and problem-solving.

Inquiry-Based and Problem-Based Learning (PBL):

- CBL shares foundations with Problem-Based Learning (PBL) from the 1960s.
- PBL focuses on structured problems, while CBL uses open-ended, real-world challenges.

Apple Education Community

- CBL-Framework with three interconnected phases — Engage, Investigate, and Act. (2008)

Challengebasedlearning.org et. al.

- CBL-Framework, Community, Ressources, Projects



Challenge based Learning – What it is



What it is:

- Challenge-Based Learning (CBL) is grounded in **experiential learning**
- Encourages **self-directed learning** by confronting students with real-world problems
- Motivates learners to devise and implement **practical solutions to challenges**

What CBL matters:

- Stimulating the development of **deep learning** and **critical thinking**.
- Enhancing student-centered learning for better **understanding** and **retention** of knowledge.
- Helps develop life skills applicable across various domains, **supporting lifelong learning** by empowering students to:
 - Determine their own goals.
 - Find appropriate resources for learning.
 - Take responsibility for what they need to know.
- Enriches educational experiences **across schools**, vocational training centers, and higher education institutions.

CBL Phases



CBL Activities



CBL Phase 1: Engage



Learners move from a Big Idea to a concrete and actionable Challenge using the essential questioning process.

- A **Big Idea** can be anything important to your community or classroom. **Health, communication, geometry, and relationships** are all great examples of Big Ideas.
- The **Essential Question** is formed to **contextualize and personalize the Big Idea**. Learners ask, **Where does the Big Idea intersect with my world?** in order to help land on one Essential Question.
- The **Challenge** is created to make the Big Idea and Essential Question **actionable** and to build **excitement**.

*As a **facilitator** you can select a Big Idea, Essential Question, and Challenge for your learners — or build each together.*

CBL Phase 3: Act



During the **Act phase** of CBL, learners **develop and implement solutions with an authentic audience**, and then **evaluate** them based on the results. The Act phase combines the **desire to make a difference** with demonstration of **content mastery**.

- Learners first **develop an actionable solution** based on the synthesis of their research.
- Learners **implement their solution** in an authentic setting.
- Then they **evaluate the effectiveness** of the solution based on results.

The CBL Framework is flexible, and allows for additional investigation based on the results when a solution is put into action. Continue to encourage ongoing questioning, research, and implementation refinement.

CBL: Document, Reflect, Share



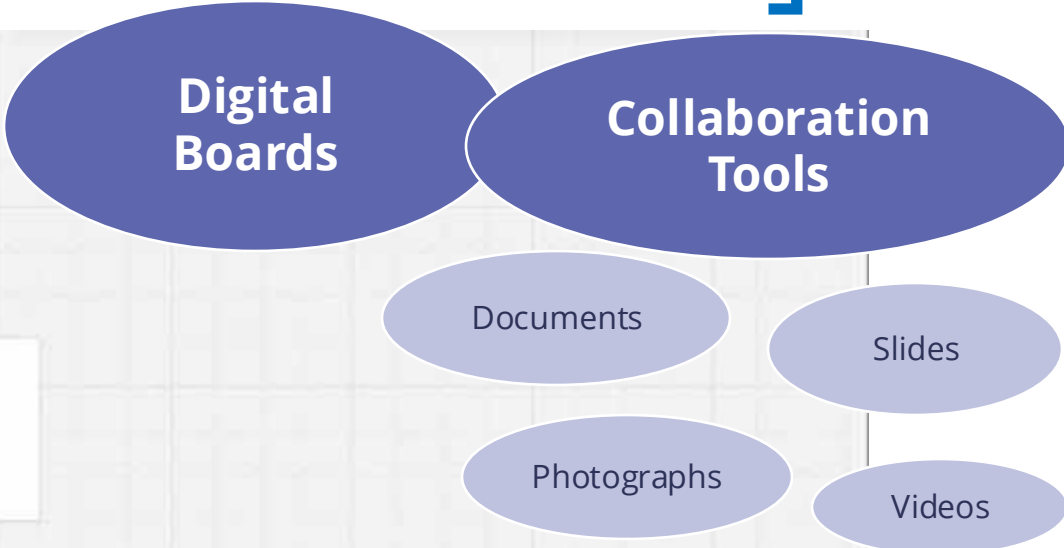
- Learners **document their experience** using audio, video, images, photography, Web ...
- Ongoing collection of content provides the **resources for reflection the learning process.**
- There are **two pathways:**
 - 1. Personalise a mini-challenge**, starting with a big idea that learners are passionate about and document the experience.
 - 2. Create a mini-challenge with your students** that focuses on a big idea that aligns with the scope and sequence of the curriculum.
 - As a group experience to develop more individualised challenges.
 - As a whole class experience

CBL: Document, Reflect, Share



The screenshot displays a digital workspace with several sections:

- Team management und moderation:** Contains a circular diagram with four segments, a pie chart, and several small images of people.
- Team Challenge: Robotics & IoT:** Features a flowchart with steps like 'Requirements', 'Implementation', and 'Evaluation'. It also includes photos of a robot and a person working at a computer.
- Themen/Definitio Teammanag... Results for Presentation:** Shows a Gantt chart on the left and a collage of images on the right, including a robot, a person, and a presentation slide.



CBL: Document, Reflect, Share



Feedback-
talks



Assessment
Presentations

CBL Phase 2: Investigate



The builds from the Challenge. Learners **ask important questions, conduct research,** and **build a foundation** for actionable and sustainable solutions.

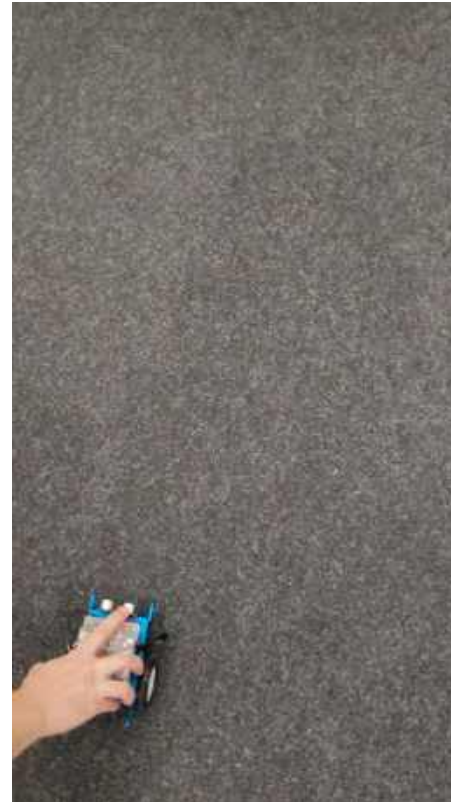
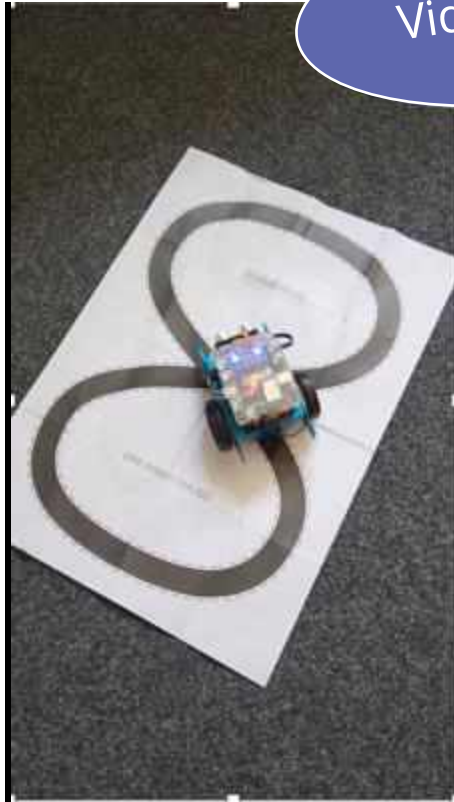
- Learners start by generating **Guiding Questions** that represent everything they need to **understand** in order to develop an informed solution.
- Learners identify **Guiding Activities and Resources** that will serve as the foundation for research and exploration.
- Learners **analyze and synthesize their research findings**, creating a foundation for innovative and sustainable solutions.

Investigate is the heart of CBL and the phase where the most time is typically spent.

CBL: Document, Reflect, Share



Video Studies



CBL: Document, Reflect, Share



Promotion
Video

Challenge Levels



CBL Level	Roles and Features
Non CBL	No CBL features are present
Mild CBL	A learning supervisor (expectation manager, process facilitator)
	Field experts and professional advisers
Moderate CBL	A learning supervisor (expectation manager, process facilitator)
	A coach (a learning guide)
	Field experts and professional advisers
Intense CBL	A learning supervisor (expectation manager, process facilitator)
	A coach (a learning guide, co-researcher/co-designer/co-learner)
	Field experts and professional advisers

Figure: Graff, R. (2023)
DOI: [10.13140/RG.2.2.22515.09769](https://doi.org/10.13140/RG.2.2.22515.09769)

Challenge Dimensions

Nano Challenge

- Short in length (5 -10 Days)
- Focus on a specific content area or skill.
- teacher or student created.
- Investigation and Act at a lower level
- Often used as scaffolding, leading to more significant Challenges
- Also used during longer Challenges to address specific concepts.
- Best choice, when the learning environment is constricted by curriculum, time, or assessments.

Mini Challenge

- Longer duration (2-4 weeks)
- more in-depth research
- reach of Solutions.
- Taking a “show me what you can do” perspective,
- Good for intense learning experiences that stretch the Learners
- Can be used to prepare Learners for Macro Challenges.

Macro Challenge

- The Macro Challenge builds on the skills of the Nano and Mini Challenges.
- Macro Challenges are longer (one month and longer)
- allow considerable latitude for the Learners

CBL: Nano Challenges

- Nano Challenges are short in length, focus on a specific content area or skill, have tight boundaries, and are more teacher-directed.
- The Learners typically start the Challenge without identifying a Big Idea or Essential Question. The challenge can be teacher or student created.
- The process includes the Investigation and Act phases but at a significantly lower level of intensity and often stopping short of implementation with an external audience.
- Often, Nano Challenges are used as scaffolding, leading to more significant Challenges or used during longer Challenges to address specific concepts.
- Nano Challenges can be used when the learning environment is constricted by curriculum, time, or assessments.

CBL: Mini Challenges

- The longer duration of a Mini Challenge (2–4 weeks) allows for more in-depth research and reach of Solutions.
- Taking a “show me what you can do” perspective, Mini Challenges are good for intense learning experiences that stretch the Learners and can be used to prepare Learners for Macro Challenges.

CBL: Makro Challenges

- The Macro Challenge builds on the skills of the Nano and Mini Challenges.
- Macro Challenges are longer (one month and longer) and allow considerable latitude for the Learners.

CBL Integration into Curriculum

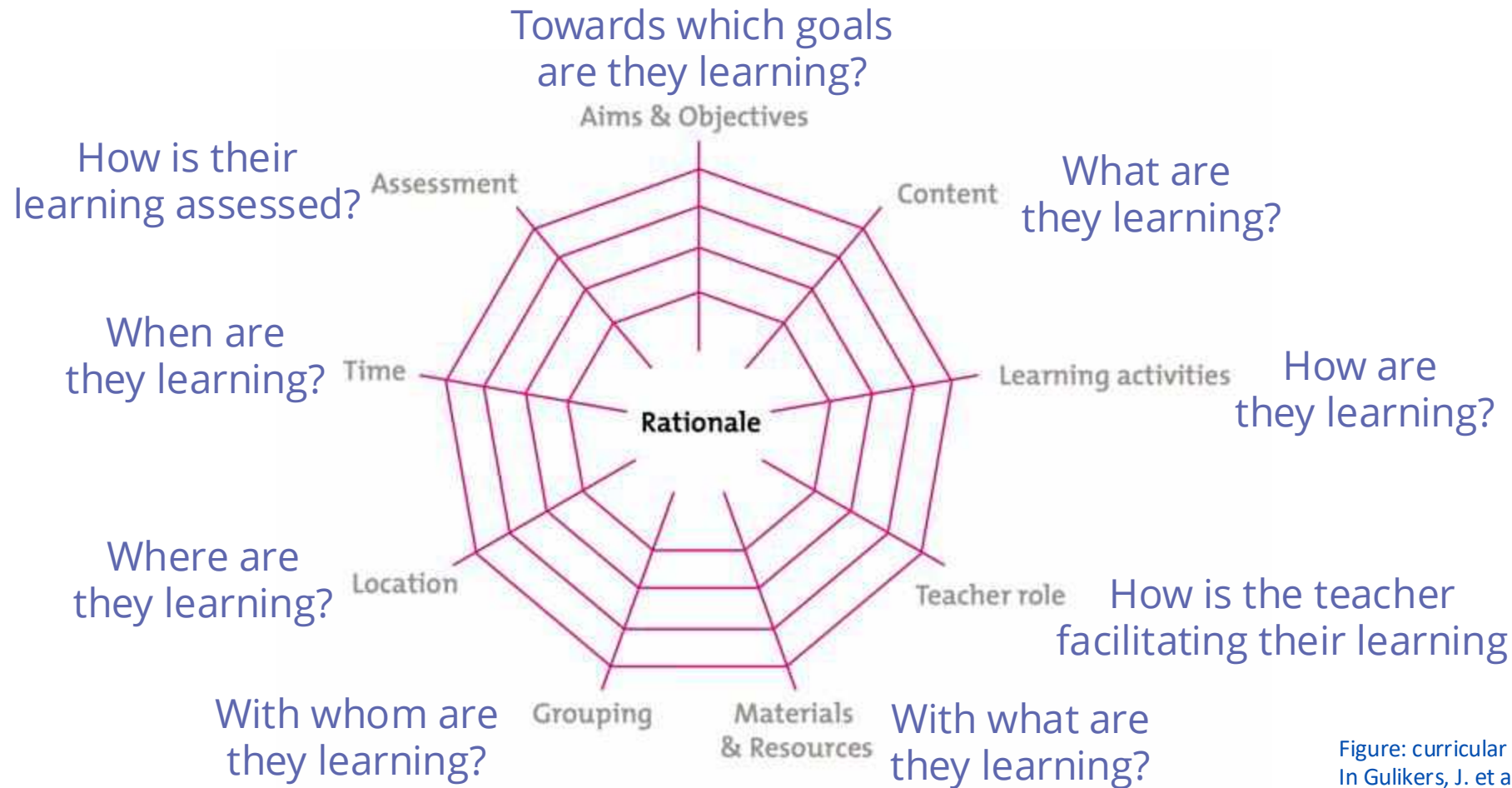


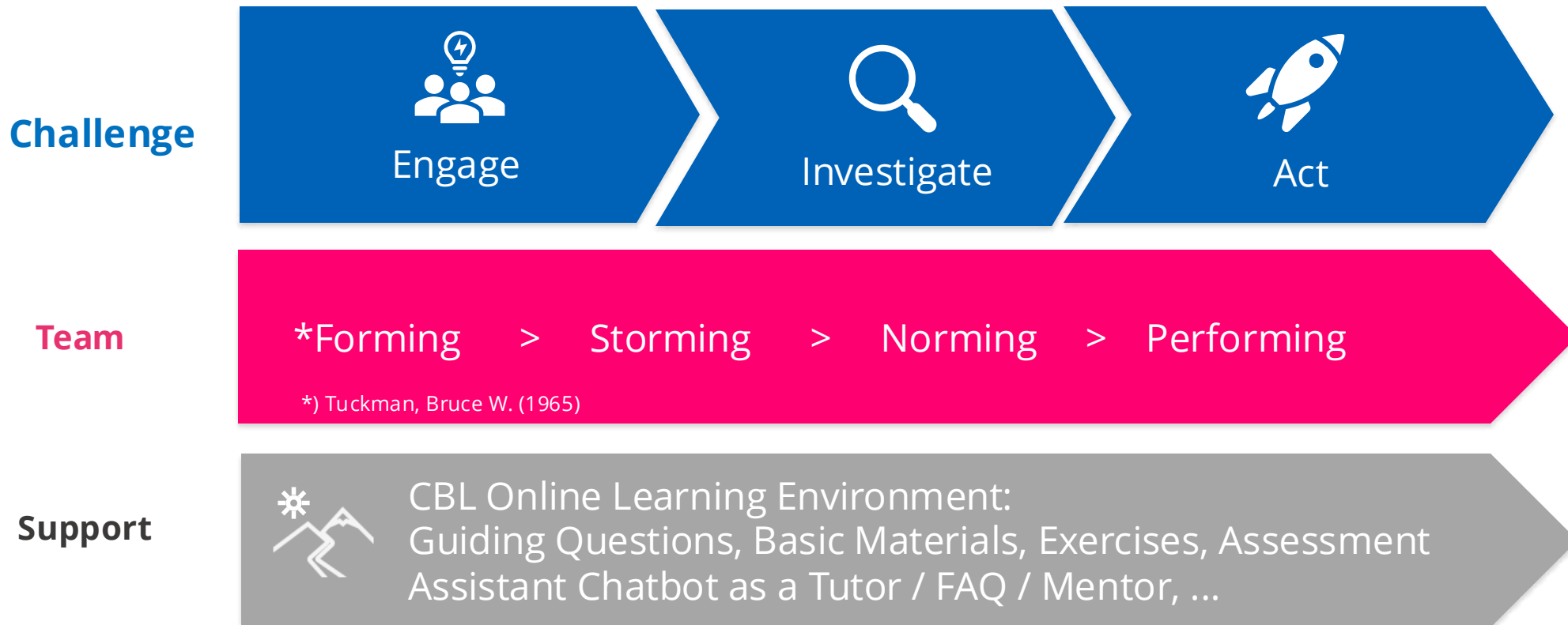
Figure: curricular spider web (Van den Akker 2003)
In Gulikers, J. et al. DOI: [10.1080/13636820.2019.1688854](https://doi.org/10.1080/13636820.2019.1688854)

Challenge based Learning – Guiding Questions

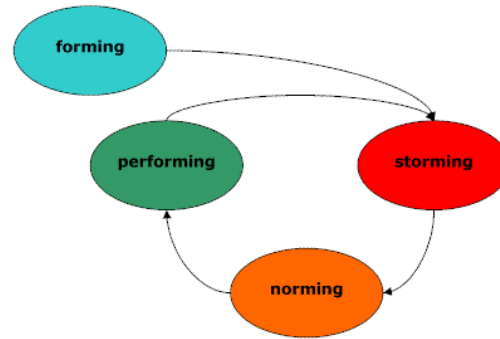


- 1** **What is the Design for a challenge-based scenario tailored to a specific Curriculum?**
- 2** **How might we effectively engage and motivate students using a challenge-based scenario?**
- 3** **How might we develop and integrate a chatbot into a challenge-based scenario?**

Layers and Stages in a Challenge Based Learning Process



Team Process in a Challenge Based Learning Process

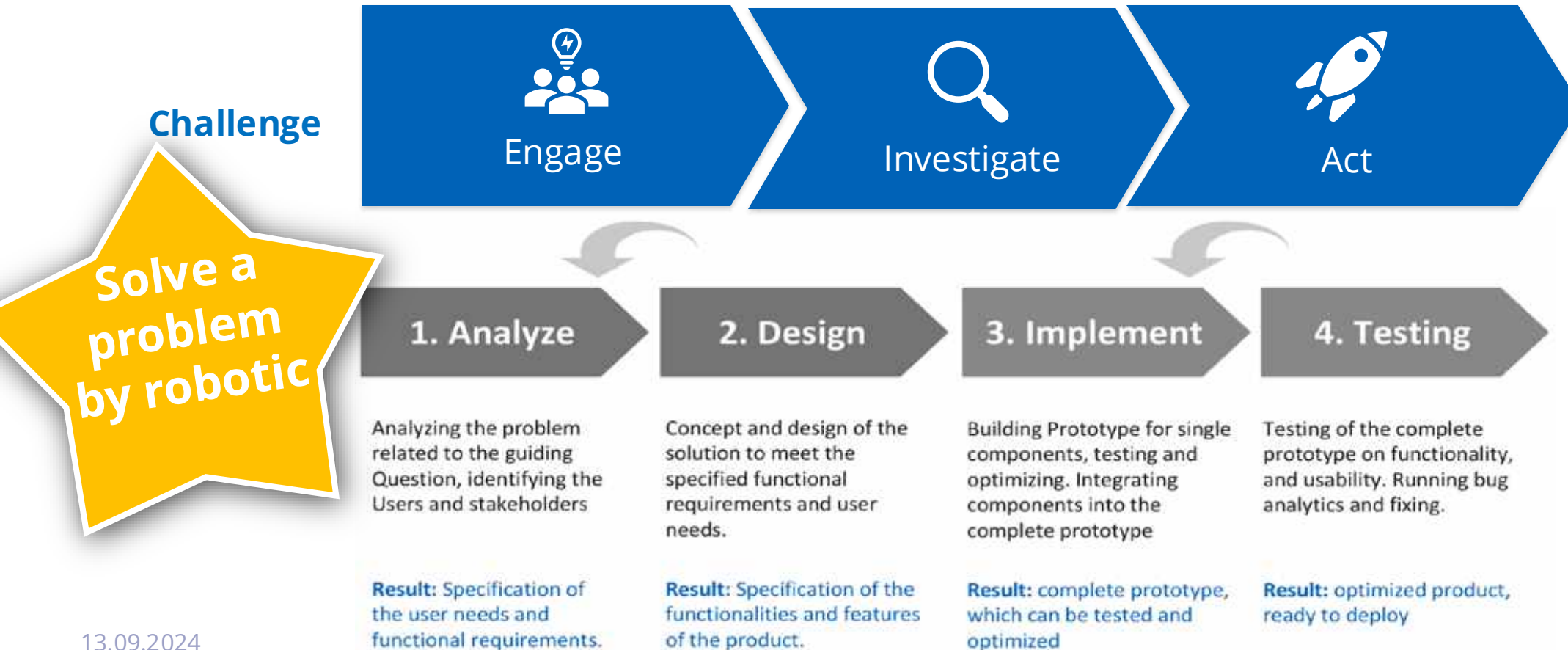


Bruce W. Tuckmans
Model of group
development since
the 1960s

Team

*Forming > Storming > Norming > Performing

Layers and Stages in a Challenge Based Learning Process



CBL Scenario Content

Course 4: Internet of Things and Robotics

CLB Scenarios Option 1: Healthbot

- Analyze and design requirements and needs in a specific situation
- Design a robotic and IoT-based solution,
- Present the solution and receive feedback on it

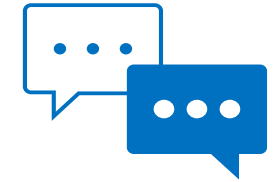
CLB Scenarios Option 2: Farmingbot

- Build a prototype for agricultural robotics
- Implement two functions (obstacle avoidance / color recognition)
- Present the prototype and receive feedback on it

Challenge-Based Learning **with Chatbots**

A woman with long black hair and glasses, wearing a white t-shirt and blue jeans, stands in a meeting room pointing at a whiteboard covered in colorful sticky notes. In the foreground, a man with a beard is seated at a table with a laptop, and another person is partially visible on the right. The room is bright and modern, with a white brick wall and a window in the background.

Assistant Chatbot for CBL Support



Role:

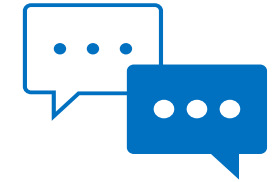
- Serves as personal learning Assistant
- Alternativ Learning Mode
- Adressing different learningtypes

Function

- Introduces to a Knowledge Domain
- Guides through challenge-based learning Process
- Glossar
- Methodology Assistant
- Tutorial
- Q&A, FAQ



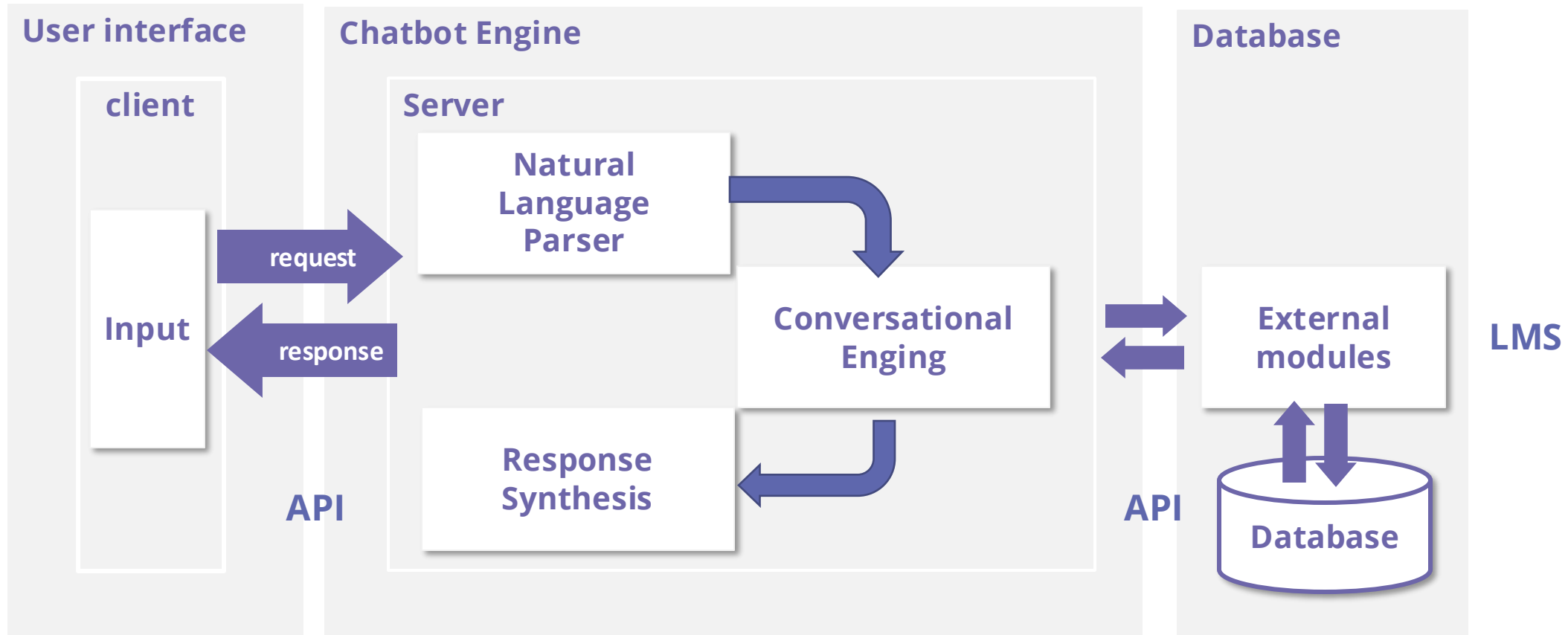
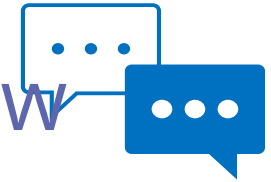
AI based Chatbot from the users Point of view



<https://smartapp.technology/blog/ai-chatbots-in-education/>

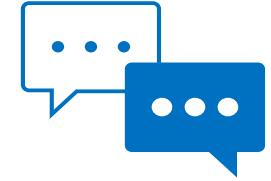


AI based Chatbot from the functional point of view



Chatbot architecture (closely based on Stäcker and Stanoevska-Slabeva 2018)

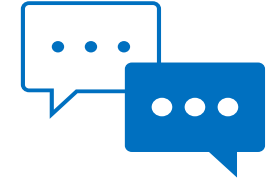
What are Educational chatbots?



- **Educational chatbots are digital tools** that assist learners using natural language processing (NLP) and machine learning algorithms to simulate human conversation.
- **They can be integrated into learning management systems,** educational apps, and websites to offer a personalized and interactive learning experience.
- **Different chatbot types** and distribution channels are important to meet educational needs of different learning scenarios.



Chatbot Benefits in HE Context



Student support: Chatbots assist with coursework and answer subject-related questions (Bala Dhandayuthapani, 2022; Cunningham-Nelson et al., 2019; Srimathi & Krishnamoorthy, 2019).

Administrative support: Chatbots automate tasks like course registration, scheduling, and grading (Ali et al., 2022; Bartneck et al., 2022).

Personalized learning: Chatbots tailor content and lessons to individual students' needs and abilities (Ashok et al., 2021; Kuhail et al., 2023; Yao & Wu, 2022).

Student engagement: Chatbots increase engagement through interactive and gamified learning experiences (Guo et al., 2023; Kuhail et al., 2023; Menkhoff & Lydia Teo, 2022).

Tutoring: Chatbots provide on-demand tutoring services, including homework help and assignment feedback (Ashfaque et al., 2020; Ji & Yuan, 2022; Koivisto, 2023; Sánchez-Díaz et al., 2018).

Mentoring: Chatbots offer personalized feedback, guidance, and emotional support (Mendez et al., 2020; Neumann et al., 2021; Salam et al., 2020; Wollny et al., 2021).

Scaffolding (challenge support): Chatbots provide guidance and support for complex tasks and processes (Jasin et al., 2023; Zobel & Meinel, 2022).

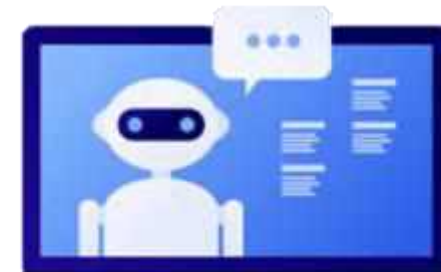
Student mental health: Chatbots support mental health and wellness, offering stress management resources (Craeto et al., 2021; Klos et al., 2021; Rathnayaka et al., 2022).

Distance learning: Chatbots offer instant access to information and support for remote learners (Ndunagu et al., 2022; Neto & Fernandes, 2019; Wollny et al., 2021).

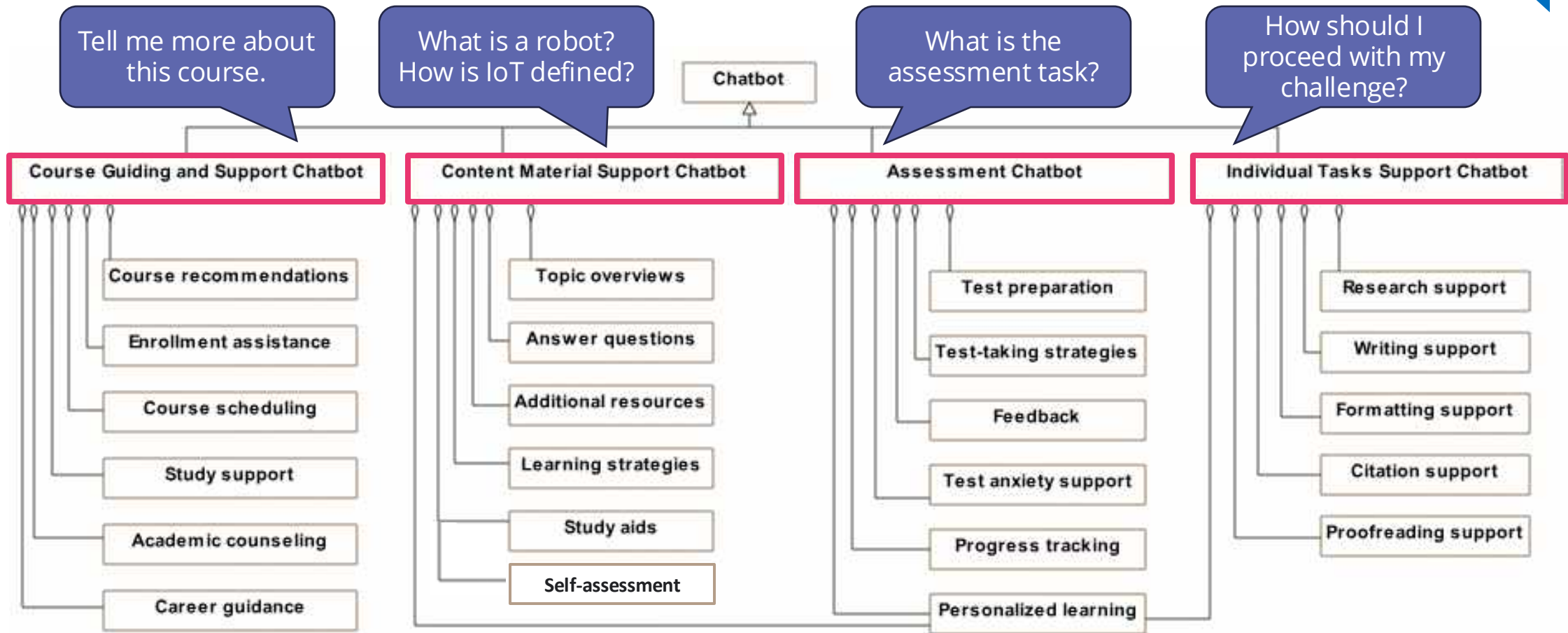
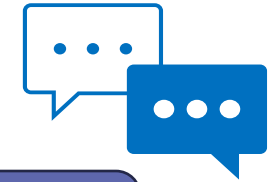
Library assistance: Chatbots help users access library resources and services 24/7 (Kaushal & Yadav, 2022; Meincke, 2018; Thalaya et al., 2022).

Cultural support: Chatbots assist users in learning about different cultures and languages (Wollny et al., 2021; Zhai & Wibowo, 2022).

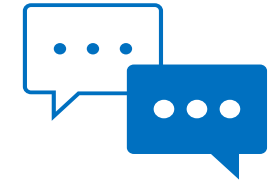
Virkus, S. et. Al.* (2024) Chatbots Scenarios for Education.



Chatbot Scenarios for CBL Support



Chatbots Benefit: Addressing Diverse Learners



Average Student

- Keeps pace generally, struggles with some concepts
- Benefits from additional explanations and personalized feedback
- Typical lectures: Lack detailed focus due to time constraints



Struggling Student

- Finds lecture pace too fast and content too complex
- Needs slower, detailed approach with repetitive reinforcement
- Large lectures: Cannot offer personalized attention



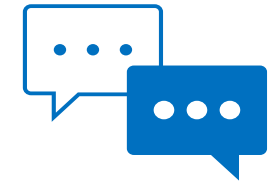
High Achiever

- Quickly grasps new concepts
- Often feels unchallenged by standard lectures
- Needs: Advanced materials and deeper exploration

Stefan Bieletzke

https://www.researchgate.net/publication/380791601_SMARTA_-_CHATBOTS_AS_INDIVIDUAL_STUDY_COACHES_FOR_TACKLING_THE_TWO_SIGMA_PROBLEM

Chatbot integration in the CBL Environment



The screenshot shows the ASSISTANT LMS interface. At the top, there's a navigation bar with 'ktu', 'Startseite', 'Dashboard', 'Meine Kurse', 'KTU.EDU', a search icon, a notification bell, a user profile 'JD', and a 'Bearbeiten' button. Below this is a sidebar with a menu icon and four items: 'General Information for learners', 'Participants Discussion / Questions', 'Chatbot Robotics and Internet of Things', and 'CERTIFICATE'. The main content area features a grid of eight topic cards:

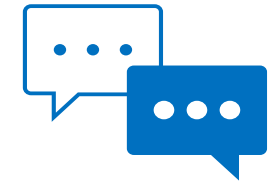
1 TOPIC 1: Introduction to Robotics and Internet of Things	2 TOPIC 2: Application of Internet of Things and Robotics	3 TOPIC 3: Functionality of IoT Devices and Robots	4 TOPIC 4: Development of IoT and Robot-based Solutions
5 Challenge #1: Designing and modeling a robot-based scenario	6 Challenge #2: Prototype for a IoT- and Robot-based Scenario	Peer Review	References



&

The chatbot interface is titled 'Robotics and Internet of Things (IoT)' and shows a conversation. The chatbot says: 'Hello 🤖 I am a chatbot and can help you improve in your skills in robotics an Internet of Things. If you have a specific question or need help in your challenge based Learning, I'm here for you 😊'. Below this, it asks: 'What would you like to know? Use a Button or enter your own question.' There are several orange buttons: 'Tell me more about this course', 'What is Robotics?', 'What is the Internet of Things?', 'Help me with my Challenge in Robotics', and 'Introduction Video by Robotics'. At the bottom, there's a text input field 'Bitte gebe eine Nachricht ein...' and a 'Powered by miloo' logo.

CBL Environment + Chatbot integration



<https://demo.melibo.de/?chatbotKey=ffa5ea6c-d408-4a34-9dee-78de46151dae>