THE ASYMPTOTE PROJECT: DEVELOPING AN ADAPTIVE AND SYNCHRONOUS LEARNING PLATFORM

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Abstract. The ASYMPTOTE system enables teachers to deliver adaptive and synchronous mathematics lessons. In doing so, teachers can select or create so-called learning graphs in a web portal. Via code, students can download these learning graphs and work on them in a self-guided manner. In the following, the ASYMPTOTE web portal and app as well as the so-called Digital Classroom feature are briefly introduced. In addition, we introduce the Erasmus+ Strategic Partnership ASYMPTOTE, under which the system of the same name is developed.

Key words: Adaptivity, ASYMPTOTE, mobile learning.

THE ASYMPTOTE SYSTEM

ASYMPTOTE aims at the delivery of adaptive and synchronous mathematics education. Following a *mobile learning approach*, only a smartphone is required on student's side to participate in online lessons conducted with ASYMPTOTE. For teachers, ASYMPTOTE offers a web portal allowing the selection of available or the creation of own learning contents, i.e., tasks or *learning graphs* (LG). With the Digital Classroom feature (part of the web portal) a synchronous monitoring tool is available.

The concept of learning graphs

In ASYMPTOTE, a LG consists of a linear sequence of mandatory tasks (main tasks, yellow) which cover the expected learning level. They are supplemented by related tasks at an easier (support tasks, green) or higher level (challenge tasks, purple). An exemplary LG is presented in Figure 1 (left). Possible ways of accessing tasks are indicated by the arrows.

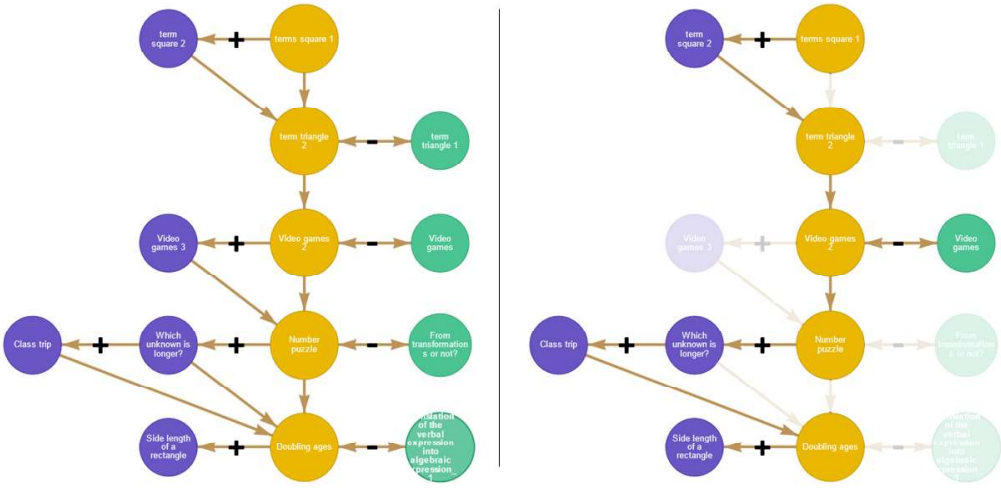

Figure 1: The LG "Reasoning and modeling with linear equations" (left) and an exemplary work process on it (right).

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Students are advised to work on support tasks if they enter a wrong solution twice in the related main task. Thus, ASYMPTOTE follows a *micro-adaptive approach*, since the next task is proposed based on performance in the previous task (cf. Plass & Pawar, 2020). The challenge tasks are optional after solving the corresponding main task. Hence, the LG concept also fosters students' autonomous and self-regulated learning (cf. Greene et al., 2011).

This is illustrated by the work process of a student shown in Figure 1 (right). After solving the first main task, the student works on a challenge task. The next main task can also be solved, while the third main task can only be solved after the associated support task has been worked on. Afterwards, the student is again able to solve the fourth and the fifth main task and additionally access three related challenge tasks. For a more detailed description of the LG concept, we refer to Barlovits et al. (2022).

The web portal

The ASYMPTOTE web portal allows (a) to create own tasks and LGs tailoring the learning content to the individual needs of the learning group. In addition, teachers can (b) select tasks and LGs from the community-based ASYMPTOTE database – a pool of tasks and LGs related to different areas of mathematics in all languages of the project partners (see final section).

The smartphone app

The smartphone app represents the students' view on ASYMPTOTE. Within the app, the learners work on LGs in their own pace. Teachers provide their students access to LGs via a code, which has to be entered in the app. In Figure 2, an exemplary working progress of a student is displayed.

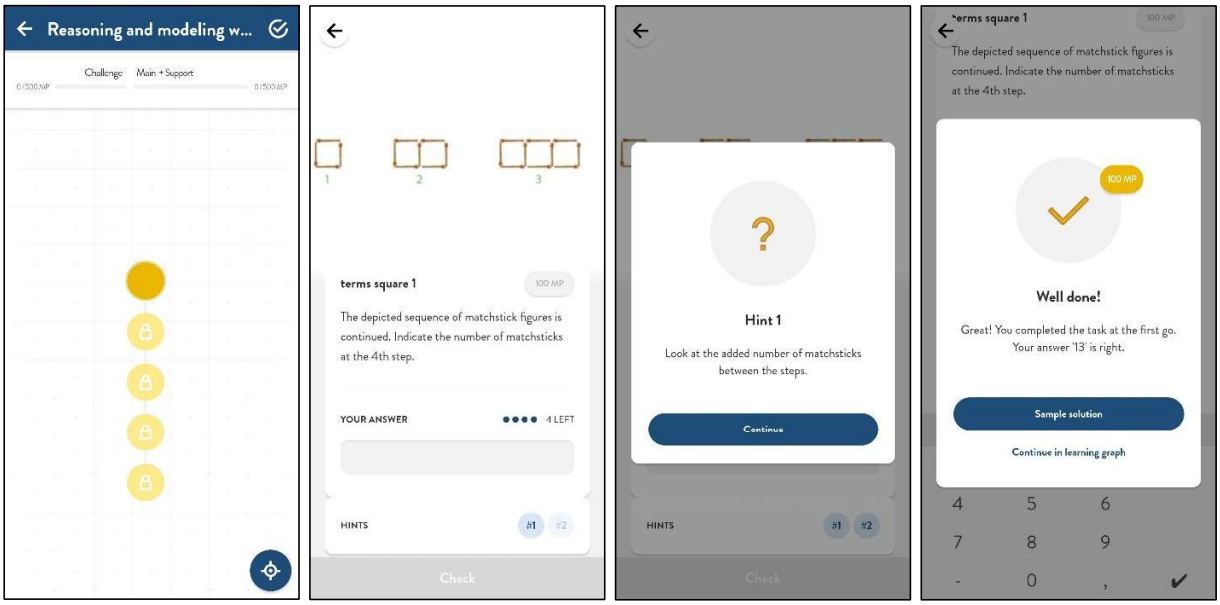

Figure 2: Students' view of the ASMYPTOTE app: accessing a LG and a task including hints and answer validation (from left to right).

A LG starts with the first main task. Selecting this task opens the task view consisting of a task image, a task formulation and an answer field for entering the calculated solution. In

addition, hints are provided for the students in order to guide their work process. After the learners enter their calculated solution, the answer will be directly validated by the app. Furthermore, a sample solution can be viewed.

After completing a LG, students receive an individual summary of their work process. They can restart the LG at any time to process the LG again, e.g., for repeating the topic.

The Digital Classroom

The Digital Classroom feature is the third component of ASYMPTOTE. It provides a direct link between the web portal and the smartphone app for *synchronous* online sessions. While the students work on the chosen LG, the teacher can monitor their progress in real time. Therefore, a class overview on all students and an individual event-log for retracing the individual work process is offered. In addition, the Digital Classroom includes a *teacher-student chat* to allow a direct teacher-student interaction. Hence, the Digital Classroom feature makes the ASYMPTOTE system applicable not only for homework or exam preparation but also for online lessons and blended learning phasis.

THE ASYMPTOTE ERASMUS+ PROJECT

The ASYMPTOTE system is developed within an Erasmus+ Strategic Partnership (DAAD; grant no. 2020-1-DE01-KA226-HE-005738) of the same name. Hereby, ASYMPTOTE stands for “Adaptive Synchronous Mathematics Learning PaThs for Online Teaching in Europe”. It is carried out by seven institutions from Germany (Goethe University, University of Bielefeld & Autentek GmbH), Greece (University of the Aegean), Italy (University of Catania), Portugal (Polytechnic Institute of Porto) and Spain (teacher federation FESPM). Within the project, six Intellectual Outputs are pursuit to enrich the technical development with exemplary learning content, a long-term curriculum, scientific evaluation, and dissemination activities. The latter includes an 11-day intensive study programme for teacher students (Sep. 2022), an international teacher training (Oct. 2022), as well as a massive open online course (MOOC) for teacher students and in-service-teachers (Oct.-Dec. 2022).

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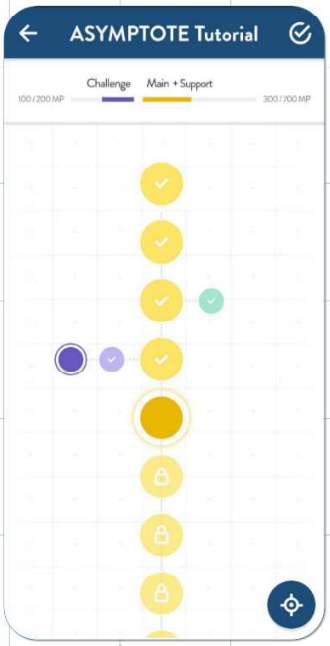
ASYMPTOTE stands for *Adaptive Synchronous Mathematics Learning Paths for Online Learning in Europe.*
It aims to deliver adaptive and synchronous mathematics lessons via so-called **learning graphs**.



Erasmus+ Strategic Partnership
DAAD; 2020-1-DE01-KA226-HE-005738

Consortium

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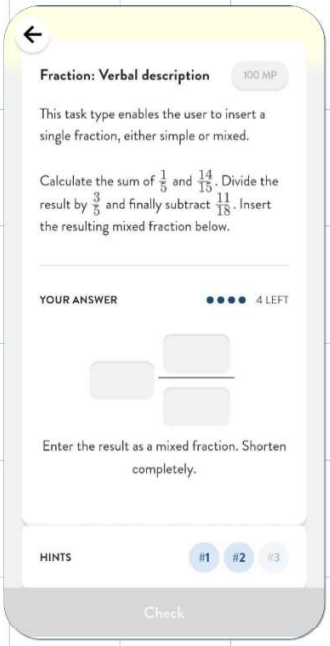
Erasmus+ Intellectual Outputs (IO):

- IO1 – Web Portal
- IO2 – App
- IO3 – Generic Tasks
- IO4 – Generic Tasks, Handbook
- IO5 – Long-term Curriculum, MOOC
- IO6 – Research, Validation



Features

- ✓ Adaptivity through challenge & support tasks
- ✓ Synchronicity via the Digital Classroom
- ✓ Multilingual open task pool
- ✓ International teacher community

Contact

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