Flexible Environment for Supervising Simulation-Based Learning Situations

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1. FORMID environment: a complete system to set up distant practical works

In this paper, we address the usability of an observation tool included in FORMID [1], an environment intended to design (teachers), execute (learners) and observe (teachers/supervisors) practical work sessions. These sessions engage a group of learners to solve a problem by interacting individually with a simulation. Our proposal concerns very fine-grained observation of students learning at the opposite of the one described by [2].

The FORMID environment is composed of three distinct tools: (1) FORMID-Author for designing computer-supported practical work sessions, (2) FORMID-Learner for engaging learners into such sessions and storing learning traces in a database, (3) FORMID-Observer, on which this paper focuses, for making teachers aware of the class progression throughout a session, thanks to the database.

Learning sessions managed by FORMID are centered on learners’ interactions with external simulations. Any simulation can be used on condition that its variables can be consulted and set up from the outside. Teachers use FORMID-Author to design pedagogical scenarios for a set of exercises, each of them using a maybe different simulation. A scenario is structured in steps, each of them including:

- the goal to be achieved by each learner on the simulation: i.e. a condition on the final simulation state to be evaluated (as correct or not) and traced each time the learner requests an end-of-step validation;
- a set of specific situations on the simulation, each revealing a typical error (or at the opposite a good behaviour) to be automatically detected and traced during the current step: i.e. a condition on the simulation state whose value will be observed by automatic frequent inspections.

At run time FORMID-Learner will track the elements described above. Other Learning Management Systems can inform the teacher about learners’ actions like “end-of-step validations”. To go further, FORMID-Observer provide the supervisor with semantic information on how the learner solves (or tries to solve) the current step. In the same way than [3], at the design stage, by setting for each step which simulation states could be meaningful in the learner progression, teachers choose which content related indicators [4] they want to later observe during a FORMID learning session.

The next paragraph focuses on FORMID-Observer, highlighting how its three visualization levels may offer to teachers, acting as supervisors, the desired flexibility that could infer their own sensibility and expertise while monitoring a practical work session. We conclude by summarizing an experiment which is aimed at analyzing usage of FORMID-Observer during a typical FORMID-managed practical work in electricity involving secondary school students.
2. FORMID-Observer: a flexible environment for teachers acting as tutors

Semantic learning traces resulting from the execution are based on (1) each learner's successive end-of-step validation requests and their value (correct or not); (2) each learner's specific situation detection that occurs and their value (error or good behaviour). Based on these learning traces, FORMID-Observer includes functionalities which are not offered by current Learning Management Systems.

A first degree of flexibility stands on the indicators definition at the design stage. When defining an exercise, the teacher specifies what the execution tool will control during the learner's progression. According to his pedagogical approach, to the targeted learners group and to his knowledge of past teaching practices, the teacher can define steps, associated end-of-step validation conditions to be evaluated on learner's request and specific situations to be automatically detected during a step. Thereby, when the teacher acts as tutor in order to monitor a session, he can observe precisely the kind of traces he specified for each exercise step.

Another degree of flexibility results from the FORMID Observer interface which can display learners’ progression through three distinct views (levels).

The main interface includes the list of learners on the left part, the structure of the supervised session (the exercises and their steps) on the upper part and the central progression zone whose content depends on the chosen level of perception.

**Level 1 - synthetic perception of the whole group progress:** The teacher can compare the respective progression of learners among the complete sequence of exercises, as well as their progression in the context of each exercise. Different colours show the progression throughout the steps as commented in figure 1. This level allows diagnosing the average activity of the class and quickly identifying gaps of progression between learners.

![Figure 1. FORMID-Observer, a part of level 1.](image)

**Level 2 – chosen step visualization** (Fig 2): The last column on the right displays all end-of-step validations successively requested by the learners. Other columns detail each detected specific situation, thus making the teacher aware of typical or recurrent errors made either by a specific learner, either by the whole class.
Level 3 – Chosen learner progression throughout a chosen step (Fig. 3): This level makes teachers aware of the chronological activity of a single learner in a given step. Lines show which control has been triggered by the learner at a given time, thus reading top-down the screen, the teacher can evaluate precisely the approach used by the learner when facing problems.

Inside a given level (1, 2 or 3), the teacher can obtain more detailed information on an end-of-step validation request or on a specific situation detection. When the mouse rolls over a colourful representation of such an event, the related simulation state is displayed. This contextual information provides the teacher with additional insights that allow him to precisely know what's good or wrong in the related simulation state.

3. Teachers’ supervision with FORMID: Analysis and work in progress

FORMID-Observer has been experimented on various sessions along the four past years. In a recent analysis intending to set teachers’ observation preferences against the FORMID-Observer features, we collected a great amount of data (teachers’ usage of FORMID-Observer, recorded via both an internal and an external system and linked to their verbal comments) that confirms this system usability in accordance to teachers’ needs and habits. Work in progress tackles the question of real time modification of the predefined scenarios and associated dynamic generation of the supervising interface.

References