Scenario 2: ***Intermediate approach*** (Structured/Guided Inquiry)

In the structured inquiry level, the question and the detailed procedure for the utilization of the remote/virtual lab are provided by the teacher. However, the students generate an explanation supported by the evidence they have collected by experiencing the remote/virtual lab by themselves. They are responsible for uncovering the answer. The teacher acts as a knowledge facilitator, providing support or materials in the microMOOC so that the students can experience a sense of success when working at this level.

Also in this case the microMOOC topic will be previously introduced by the teacher. Because this kind of inquiry is more involving than the first level, it is most successful when students have numerous opportunities to learn and practice different ways to plan experiments and record data. Therefore, after the microMOOC vision, the students should have the possibility to repeat the experiments (in class or at home) by changing the parameters. They will be invited to write a scientific report on the experience done and on acquired concepts.

Main student outcomes: Practical applications of the theory; reasoning efforts to generate explanations on the basis of their own investigation results.

Recipe for the microMOOC realization (with an example):

STEM Laboratories: https://phet.colorado.edu/en/simulation/legacy/faraday - virtual laboratory, needs upload java applet on personal device

"Electromagnetic Induction": http://kdt-20.karlov.mff.cuni.cz/ovladani_2_en.html - remote lab

STEP 1: *Engagement* –

Teacher: introduces the microMOOC learning environment about a topic (Electromagnetic induction) already studied by students, contextualizing it in real-life interesting environments (Dynamo, alternators in power plants, eddy current brakes, electrical transformers, electric guitar, recording and reproduction of magnetic sound, etc).

Student assignment: make connections among existing knowledge and the topic (electromagnetic induction in real life) that should be learned, ask their own questions about the topic.

STEP 2: *Exploration* –

Teacher: provides materials, explains the involved phenomena, illustrates the procedure and the method for the lab exploration.
(Faraday's Electromagnetic Lab: https://phet.colorado.edu/en/simulation/legacy/faraday).

Student assignment: conduct the investigations by themselves, beginning with the exploration of "Bar magnet" and "Pickup coil". In particular, their task is searching for information, raising questions,

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developing hypotheses to test, acquiring and collecting data (For example, how the effect depends on the polarity, on the velocity of the bar magnet, on the loop area, etc).

STEP 3: *Explanation* –

Teacher: acts as a facilitator in the acquiring of information from the data recorded during the experimental phase. In particular, facilitates the building of models, the testing of the hypotheses, the design of new experiments, the explanation of the results.

Student assignment: guided by the teacher, individually or working in group generate an explanation supported by the data collected by the exploration of the remote/virtual lab. In order to have success they use all available resources in the labs (Flip polarity, see inside magnet, show field meter, number of loops, etc). They are responsible for uncovering the answers.

STEP 4: *Extension* –

Teacher: invites the students to explore again the virtual experiments in class or at home looking for different variables or different relationships (for example by exploiting "Electromagnet" or "Transformer" with dc and ac fields); suggests to students to use a remote laboratory (for example "Electromagnetic Induction": http://kdt-20.karlov.mff.cuni.cz/ovladani_2_en.html); gives directions to the students about how to write a report explaining the results.

Student assignment: explore the electromagnetic induction by using dc and ac fields. Use the remote lab, building possible generalizations. Create a scientific report (individual or for groups) about the work done and the reinforced concepts.

STEP 5: *Evaluation* –

Teacher: determine how much learning and understanding has taken place at the end of the learning experience by means of exercises, evaluation tests etc.

Student assignment: peer review of the reports.

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