Using Mobile Augmented Reality Games to develop key competences through learning about sustainable development [UMARG]

Erasmus+ / Strategic Partnerships for adult education; Ref. no.: 2019-1-RO01-KA201-063778

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Learning, Teaching and Training Activity
19-23 April 2021

Module 2: *Assessment tools for measuring students' digital and civic key competencies achieved through the use of Mobile Augmented Reality Games*
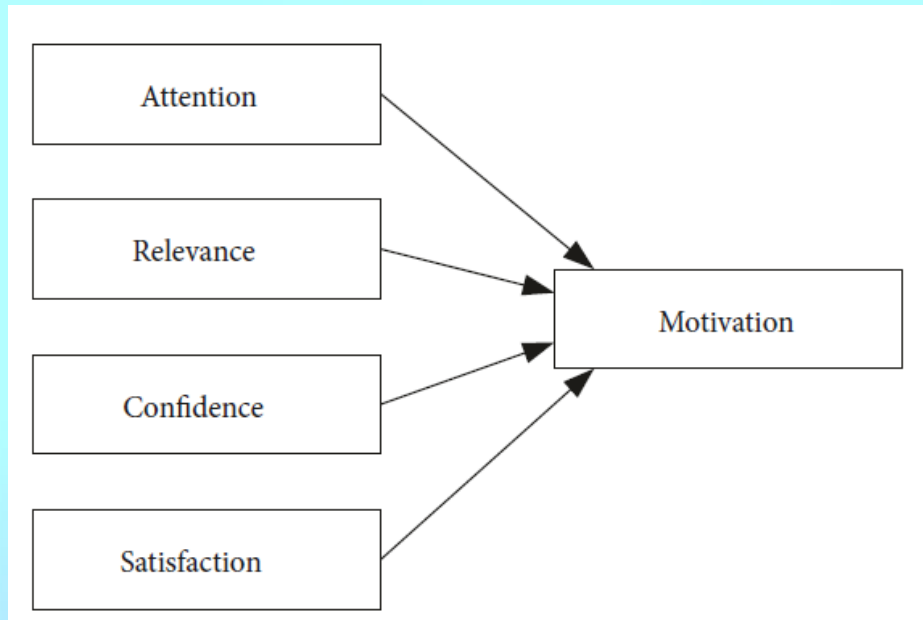
Prepared by: University of Piteşti
Assoc. Professor Dr. Georgeta Chirleşan

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Theoretical aspects regarding Learning Outcomes' assessment   (1)

- Researches emphasized that the use of AR may increase student learning motivation and contribute to improved academic achievement [4, 5].

- The potential of AR in education remains unexplored and there is a limited amount of studies investigating student motivation with the use of AR.

- Khan et al. (2019) [1] found out that here is insufficient research on the impact of using Mobile AR in education and *"there is room to explore the potential of AR to improve student learning motivation and contribute to improved academic achievement"* [2, 3, 4].

- The skills and knowledge that students develop through technology-enhanced learning environments may be developed <u>more effectively</u> through AR technology [6].

- After any teaching-learning process *assessment of the achieved Learning Outcomes*, should follow.

- Likewise, after using MARGs, teachers should assess

    (1) how students' motivation has changed and also

    (2) what KSCs their students have acquired.

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Theoretical aspects regarding Learning Outcomes' assessment   (2)

Keller's ARCS model of motivational design was used to understand the impact of AR technology on student motivation towards learning [2, 5, 7, 8].

```
┌──────────────┐
│  Attention   │
└──────────────┘
┌──────────────┐                    ┌──────────────┐
│  Relevance   │                    │  Motivation  │
└──────────────┘                    └──────────────┘
┌──────────────┐
│  Confidence  │
└──────────────┘
┌──────────────┐
│ Satisfaction │
└──────────────┘
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Theoretical aspects regarding Learning Outcomes' assessment   (3)

Learning and assessment should not be separated!

Principles of Learning

Learning requires the active participation of the student.

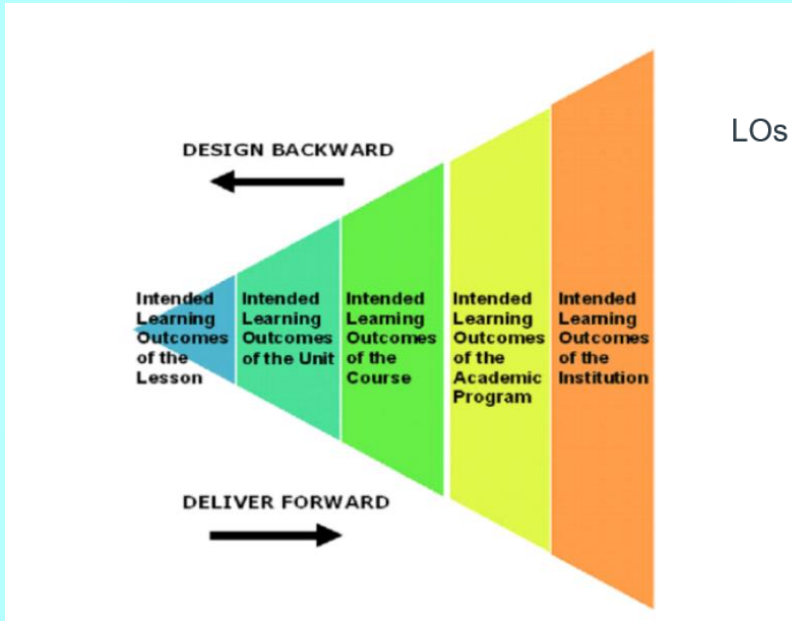People learn in a variety of ways and at different rates.

Learning is both an individual and a group process.

Learning is most effective when students reflect on the process of learning and set goals for improvement.

Principle 1:	Assessment should be **valid**
Principle 2:	Assessment should be **reliable** and **consistent**
Principle 3:	Information about assessment should be **explicit, accessible** and **transparent**
Principle 4:	Assessment should be **inclusive** and **equitable**
Principle 5:	Assessment should be an integral part of programme design and should **relate** directly **to the programme aims and learning outcomes**
Principle 6:	The amount of assessed work should be **manageable**
Principle 7:	**Formative** and **summative** assessment should be included in each programme
Principle 8:	Timely **feedback** that promotes learning and facilitates improvement should be an integral part of the assessment process
Principle 9:	**Staff development** policy and strategy should include assessment

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Theoretical aspects regarding Learning Outcomes' assessment   (4)

Developing Learning Outcomes (LOs)

DESIGN BACKWARD

Intended Learning Outcomes of the Lesson | Intended Learning Outcomes of the Unit | Intended Learning Outcomes of the Course | Intended Learning Outcomes of the Academic Program | Intended Learning Outcomes of the Institution

DELIVER FORWARD

LOs are essential because they:

- define the type and depth of learning students are expected to achieve
- provide an objective benchmark for formative, summative and prior learning assessment
- clearly communicate expectations to learners
- define coherent units of learning that can be further subdivided or modularized for classroom or other delivery modes
- guide and organize the instructor and the learner
- clearly communicate graduates' skills to prospective employers

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Theoretical aspects regarding Learning Outcomes' assessment (5)

Developing Learning Outcomes (LOs): the "ABCD" approach

Writing Effective and Measurable Objectives: The A-B-C-D Model		
Element	**Description**	**Example**
A = Audience	Who is performing the action? Learning objectives are always stated in terms of student outcomes.	Following completion of the Science program, <u>the student</u> should be able to plot a quadratic equation using a graphing calculator in two minutes or less.
B = Behavior	What will the student be able to do? Use Bloom's Taxonomy and action verb that describe an accomplishment that is measurable.	Following completion of the Science program, the student should be able to <u>plot a quadratic equation</u> using a graphing calculator in two minutes or less.
C = Condition	Give the conditions under which the performance will occur. Be specific.	<u>Following completion of the Science program</u>, the student should be able to plot a quadratic equation <u>using a graphing calculator</u> in two minutes or less.
D = Degree	Describe the minimum criteria for acceptable student performance.	Following completion of the Science program, the student should be able to plot a quadratic equation using a graphing calculator <u>in two minutes or less.</u>

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Theoretical aspects regarding Learning Outcomes' assessment   (6)

Developing Learning Outcomes (LOs)

Useful advices for teachers when writing LOs:

1. Focus on the student - what the student will be able to *do* by the end of the teaching-learning process.
2. Describe *outcomes*, not processes or activities.
3. Start each outcome with an *action verb*.
4. Use only *one* action verb per learning outcome.
5. *Avoid vague verbs* such as *know* and *understand*.
6. Check that the verbs used reflect *the level of learning* required.
7. Ensure that outcomes are *observable* and *measurable*.
8. Write the outcomes in terms of what the *learner does*, not what the teacher does.
9. Check that the outcomes reflect *KSAs required* (for personal development, professional development, in the workplace or the wider community).
10. Check that there is an *appropriate number* of outcomes.

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- *Write one Learning Outcome based on ABCD approach and share it with other participants!*

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- *Which questions do you ask yourself when designing a student assessment?*

- *How do you think your student evaluation should be, what main features it should have, what objectives do you envisage?*

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Theoretical aspects regarding Learning Outcomes' assessment   (7)

Advices to teachers for efficient assessment:

1. Clarify for your students what good performance is (goals, criteria, standards). Define the expectation!

2. Encourage 'time and effort' on challenging learning tasks!

3. Deliver high quality feedback information that helps learners self-correct!

4. Encourage positive motivational beliefs and self-esteem!

5. Encourage interaction and dialogue around learning (peer and teacher-student)!

6. Facilitate the development of self-assessment and reflection in learning!

7. Give learners choice in assessment – content and processes!

8. Involve students in decision-making about assessment policy and practice!

9. Support the development of learning communities!

10. Help teachers adapt teaching to student needs!

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Theoretical aspects regarding Learning Outcomes' assessment (8)

What is an assessment tool?

- Assessment tools – also called evidence-gathering tools – contain both the <u>instrument</u> and the <u>instructions</u> for gathering and interpreting evidence in an assessment process.

An assessment tool is made up of the following components:

- the context and conditions for the assessment;
- the tasks to be administered to the learner;
- an outline of the evidence to be gathered from the learner;
- the evidence criteria used to judge the quality of performance, for example, the decision-making rules;
- the administration, recording and reporting requirements.

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Theoretical aspects regarding Learning Outcomes' assessment   (9)

The rules of evidence

- Well-designed assessment tools will help to ensure that the evidence collected is:

Valid	The assessor is assured that the learner has the skills, knowledge and attributes described in the module or unit of competency and associated assessment requirements.
Sufficient	The assessor is assured that the quality, quantity and relevance of the assessment evidence enable a judgement to be made of the learner's competency.
Authentic	The assessor is assured that the evidence presented for assessment is the learner's own work.
Current	The assessor is assured that the assessment evidence demonstrates current competency. This requires the assessment evidence to be from the present or the very recent past.

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Theoretical aspects regarding Learning Outcomes' assessment   (10)

Four steps to design quality assessment tools that will help you to design assessment tools that produce quality outcomes.

Plan	
	Step 1 – Clarify the evidence requirements.
	Step 2 – Choose your assessment methods.

Act	
	Step 3 – Design and develop your assessment tools.

Reflect	
	Step 4 – Trial, refine and review your tools.

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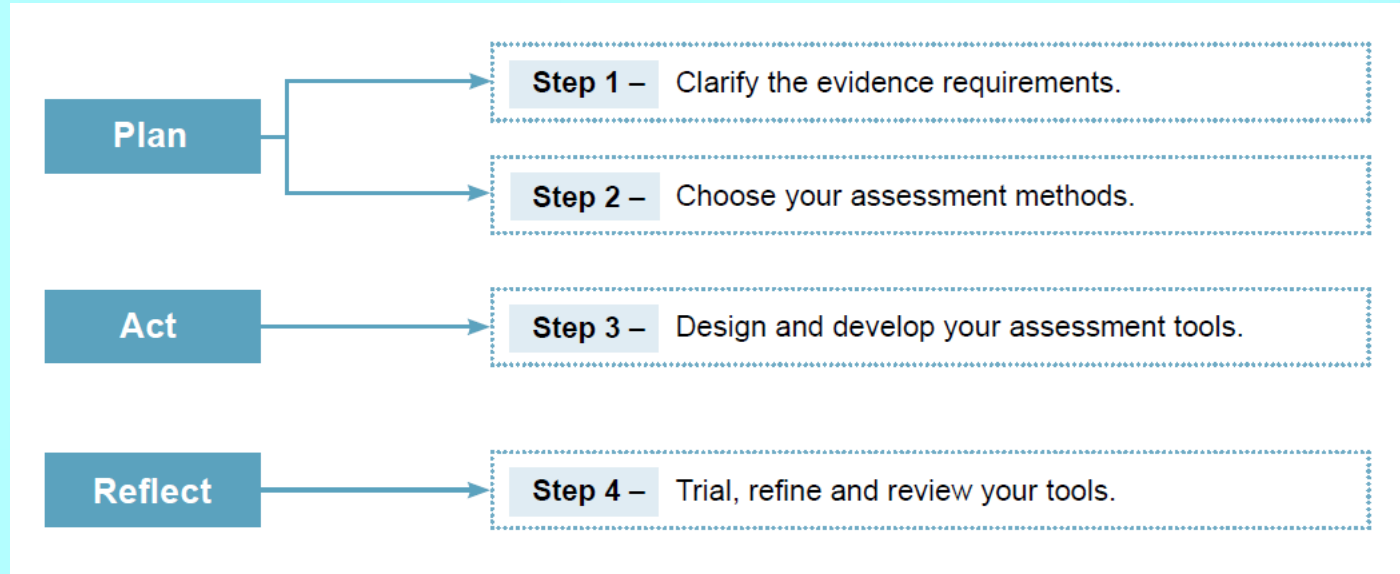
Theoretical aspects regarding Learning Outcomes' assessment (11)

Assessment methods

Methods	Examples of methods
Direct observation	• Real work/real-time activities at the workplace • Work activities in a simulated workplace
Structured assessment activities	• Simulation exercises/role-plays • Projects • Presentations • Activity sheets
Questioning	• Written questions • Interviews • Self-evaluation • Verbal questioning • Questionnaires • Oral or written examinations (may be applicable at higher AQF levels)

Methods	Examples of methods
Evidence compiled by the learner	• Portfolios • Collections of work samples • Products with supporting documentation • Historical evidence • Journals/logbooks • Information about life experience
Review of products	• Products as a result of a project • Work samples/products
Third-party feedback	• Testimonials/reports from employers/supervisors • Evidence of training • Authenticated prior achievements • Interviews with employers, supervisors or peers

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Theoretical aspects regarding Learning Outcomes' assessment   (12)

Considering your learners' needs

- The choice of <u>assessment method</u> will be influenced by a number of factors, not least of which is meeting your *learners' needs*. Your selection of methods needs to take into account their circumstances, while maintaining the integrity of the unit(s) of competency. For example:
- indigenous learners may prefer to demonstrate rather than talk about what they know;
- learners with disability may need a bit more time to complete a task;
- learners returning to study after a long period may have lost confidence and find it difficult to perform in front of others.

- Whatever adjustments you make to the assessment method, you must *ensure that evidence collected still addresses all the requirements* of the unit(s) of competency.

- This information is not always at hand at the planning stage and you will need to *adapt your methodology and assessment plan to accommodate learners' needs* as they become clearer to you. However, it is important to decide in advance how you determine learners' needs and how you will use this information to customise your assessment process.

- The choices you make will also be *influenced by* your determination of the *language, literacy and numeracy proficiency of your learners* and the Learning Outcomes envisaged.

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Theoretical aspects regarding Learning Outcomes' assessment   (13)

Other practical considerations

A number of practical considerations will also influence your choice of <u>assessment methods</u>. <u>Factors</u> that will influence your capacity to manage the evidence-gathering process that you select might include:

- the mix of learners you are working with;

- the size of the learner cohort;

- the location of your learners (on/off campus);

- your/their access to equipment and facilities;

- costs and resource requirements; and

- stress placed on learners by your requirements.

*Before you design your assessment tools, take time to consider whether the assessment methods you have selected meet the **principles of assessment**!*

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Theoretical aspects regarding Learning Outcomes' assessment   (14)

Design and develop your assessment tools

- Assessment tools contain both the <u>instrument</u> and the <u>instructions</u> or procedures for gathering and interpreting evidence. They serve the evidence gatherer's needs for objectivity and transparency as well as the learners' need for clarity and structure.

- Assessment tools should provide clear <u>guidance</u> and <u>support for learners</u> so that there is no ambiguity about what is required of them or the basis on which trainers/assessors will make decisions. They can also, if well designed, be used for recording and reporting purposes.

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Theoretical aspects regarding Learning Outcomes' assessment   (15)

Design and develop your assessment tool

Assessment tools generally make provision for the following *practical requirements*:
- the learner's name;
- the trainer's/assessor's name;
- the date of assessment;
- the title of the unit;
- the context of the assessment;
- the procedure for the assessment;
- the list of knowledge/skills/competencies to be assessed;
- the outcomes of the assessment;
- feedback for the learner;
- the learner's signature and the date;
- the trainer's/assessor's signature and the date;
- the instructions to the learner, the trainer/assessor or other evidence gatherer;
- the resource requirements of the assessment.

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Theoretical aspects regarding Learning Outcomes' assessment   (16)

Design and develop your assessment tool

Remember! The tools that you design must facilitate the gathering of evidence that is:

- valid
- sufficient
- current
- authentic

Your assessment tool gives shape and form to your chosen <u>assessment method</u>. It must, therefore, be fit for purpose, which means you need to ask yourself *which tool is needed to most effectively and efficiently support your chosen assessment method.*

Standardised tools are often a useful option, as they provide a cost-effective starting point from which you can develop your own tools.

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Theoretical aspects regarding Learning Outcomes' assessment   (17)

CIVIC LEARNING ASSESSMENT

- In relation to civic learning 2 key domains are identified: *civic competency* and *civic engagement*.

- *Civic competency* encompasses 3 areas:

  - civic knowledge;

  - analytic skills;

  - participatory and involvement skills.

- *Civic engagement* also captures 3 areas:

  - motivations, attitudes and efficacy;

  - democratic norms and values;

  - participation and activities.

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Theoretical aspects regarding Learning Outcomes' assessment   (18)

Considering the multidimensional nature of civic learning, *items in multiple formats* should be employed for an adequate coverage of the two domains:

- *Multiple-choice* items can be used to measure a wide range of factual and conceptual civic knowledge as well as the attainment of civic skills.

- *Situational judgment items* could be used to measure analytic and participatory and involvement skills. Situational judgment items can be enhanced through the use of technology.

- *Open-ended items* allow for flexibility, allowing examinees to provide written or oral responses in their own words

- *Rubrics* could be the basis for computer-based scoring.

- *Likert-type items* can measure a variety of domains such as values (social responsibility), attitudes (toward specific issues such as diversity or participation), motivation (efficacy), perceived skill levels, perceived achievement, or competency and behaviors.

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Theoretical aspects regarding Learning Outcomes' assessment   (19)

Examples of Task Types for Assessing Civic Competency and Engagement

Task type	Description
Analyze a document/argument	Examinee reviews an existing document, argument, or graphic before answering a question
Conflict resolution[a]	Examinee provides information about alternative ways to solve a conflict in various contexts
Draw conclusions	Examinee draws inferences from information provided or extrapolates additional likely consequences
Deliberation[a]	Examinee provides information about how to intervene/deliberate in a political debate or discussion in a way that furthers productive discussion
Fact checker/recognize bias	Examinee reviews and analyzes facts and opinions, recognizing misleading information and facts from opinions (or whether a statement is biased against certain groups)
Generating critical questions[a]	Examinee develops or evaluates queries to elicit information to evaluate an argument or claim
Identify compelling evidence	Examinee recognizes evidence statements with the conclusions they support or undermine
Justification (based on response to a self-report item)[a]	Examinee provides rationale for a previous response to a self-report item (e.g., Likert-type or short answer)
Perspective taking[a]	Examinee role plays, takes perspectives, or chooses which response is the best choice for particular "participants" or stakeholders with contrasting resources and/or goals
Using the past to predict/inform the present	Examinee uses historical/previous information to provide justification for a response to a stimulus
Knowledge application	Examinee analyzes knowledge presented in a table or graph (or other source) to answer a question or solve a problem

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Theoretical aspects regarding Learning Outcomes' assessment (20)

DIGITAL KEY COMPETECIES ASSESSMENT

- Digital skills are usually classified into proficiency levels: basic, intermediate and advanced.

"Digital Literacy is the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process." (DigEuLit project, eLearning Programme of the European Commission)

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Theoretical aspects regarding Learning Outcomes' assessment   (21)

DIGITAL KEY COMPETECIES ASSESSMENT

- Approaches for assessing digital skills levels

- *self-assessments*: by asking participants to rate their own level of knowledge, ability, confidence or usage; questions tend to use pre-defined scales such as Likert (e.g. scale 1 - 5), multiple-choice, or true/false.

- *knowledge-based assessments:* they test skills using questions about factual or procedural knowledge (usually by multiple-choice tests).

- *performance-based assessments*: based on realistic scenarios and by using tools such as browsers and word-processing software.

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ASSESSMENT OF STUDENTS' LEARNING ACHIEVEMENTS AFTER USING AR

- Studies [14, 15, 16, 17] have revealed that AR has the <u>potential</u> to provide participatory, situated and collaborative experiences that foster inquiry-based problem solving and critical thinking skills, but it also presents several <u>assessment challenges</u> to researchers and evaluators.

- AR and VR can create safe spaces that enable not only authentic measurable assessment (performance) but authentic learning experiences.

- AR and VR allow for the four key-themes identified for *authentic learning*:

    - real-world problems;

    - inquiry activities;

    - sharing and collaborating;

    - individual empowerment through choice.

while avoiding scenarios that in the real world are risky, even dangerous.

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Assessment tools:
1. OBSERVATION CARD

- Observation card/note is used as one of the best tools to enhance the understanding of teachers about how students are learning.
- Teachers observe and document students' skills, knowledge and accomplishments:
  - participation in classroom activities and routines;
  - interaction with peers
  - working with educational materials
- By recording what they see and hear, teachers answer questions like:
  - *what is this student paying attention to or interested in?*
  - *what experience does the student have of this?*
  - *what does the student already know about this?*
  - *what does the student feel?*
- The observation card comprises special *themes* (e.g. communication, uses of senses, etc.), *items* related to the student physical interaction with the educational tools - AR/VR devices (e.g. verbal interaction, participation in educational activities, interaction with peers, focus on the educational tools, interaction with the educational tools, etc.) and the teachers' *evaluation scale* (e.g. Likert 1-4 or 1-5).

Theme	Observation item	Teacher's evaluation	Other remarks
Theme 1	Item 1 Item2 ….	1 2 3 4 5 1 2 3 4 5	
Theme 2	Item 1 Item 2 ….	1 2 3 4 5 1 2 3 4 5	
…	Item 1 Item 2 ….	1 2 3 4 5 1 2 3 4 5	

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Assessment tools:
2. ACHIEVEMENT TEST

- **Definition:** an assessment tool to measure skills and knowledge learned in a given grade level, usually through planned instruction, such as training or classroom instruction.

- Beyond this central purpose, achievement tests differ according to their specific intended score inference and use.

- Its scores are often used to determine the level of instruction for which a student is prepared.

- Achievement tests may be used for formative or summative purposes, group or individually administered and consist of various formats, including multiple-choice items, essays, performance tasks and portfolios.

- Results from these types of tests are used to make **decisions** about student progress, instructional practices, and teacher accountability.

- The achievement tests that most people are familiar with are the **standard exams** taken by every student in school. Students are regularly expected to demonstrate their learning and proficiency in a variety of subjects. In most cases, certain scores on these achievement tests are needed in order to pass a class or continue on to the next grade level.

ACHIEVEMENT TESTS - Types

(a) Achievement test can be of different **forms** like oral test, written test and practical test.

(b) Based on types of questions: essay-type, short-answer, objective questions or combination of all these.

(c) Based on the purpose for which it is administered: diagnostic tests, prognostic test, accuracy test, power test, spit test etc.

(d) Based on time/period: summative test, daily test, weekly test, fortnightly test, monthly test, quarterly test, half yearly test, annual test or final examination at the end of course of study of an academic year.

(e) Based on content/subject: language test, reading test, spelling test, history test, geography test, mathematic test, science test etc.

(f) Based on quality: standardized test and teacher made test.

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Assessment tools:
3. FOCUS GROUP

- *Definition*: a guided discussion whose intent is to gather open-ended comments about a specific issue. For student learning assessment "specific issue" usually means student's Learning Objectives.

- Typically, a focus group includes the following *traits*:

    Consists of 6 to 10 participants (e chosen from a specific area of interest)

    Is led by a trained moderator

    Has the purpose of discussing one topic or issue in depth

- Often it is used as a qualitative method of assessment in combination with other assessment methods (questionnaires, field observations, etc.).

- Requires careful creation of an interview guide and content analysis.

- It is an information-gathering tools with quite high flexibility; it helps to understand the *"How"* and *"Why?"* behind participant comments.

- It provides a good amount of open-ended, unconstrained information.

- When compared with direct assessments of student learning, FG may contribute additional information that would otherwise not be identified through rubrics or instruments containing closed-ended questions.

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Assessment tools:
4. INTERVIEW

- **Definition:** a formal interview consists of a series of well-chosen questions (and often a set of tasks or problems) which are designed to elicit a portrait of a <u>student's under</u>standing about a scientific concept or set of related concepts.
- The interview may be videotaped or audiotaped for later analysis.
- In depth structured interviews with a handful of carefully selected students enable teacher to readily judge the extent of understanding that his/her students have developed with respect to a series of well-focused, conceptually-related scientific ideas.

What is involved?

Teacher preparation time: several hours required to develop a set of good questions, tasks and problems sets.

Preparing the students: it is essential that the student feels relaxed and at ease.

Organisation: one-on-one or in small groups, in an office or private space

Disciplines: No disciplinary constraints, appropriate for all educational fields.

Analysing results: for <u>formative</u> assessment, the teacher may want to review taped interviews with special attention to potential "misconceptions." If used for <u>summative</u> evaluation, a type of ***scoring rubric*** may be developed.

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Assessment tools:
5. PRE-USAGE AND POST-USAGE QUESTIONNAIRE

- *Definition:* a before & after assessment, to measure whether the expected changes took place.
- A standard test, survey or questionnaire is applied <u>before</u> the teaching-learning process begins *(pre-test or baseline)* and re-applied <u>after a set period</u> or <u>at the end</u> of the program *(post-test or end-line)*.
- Pre- and post-tests can be given in <u>writing</u> or <u>orally</u>.
- *Analyzing and reporting the findings*: present results in numbers as well as percentages in a table, with a final column comparing the increases or decreases between the pre- and post-test:

	Pre-Score	Post-Score	Difference	Change (%)
Female Average	28.47	36.27	7.80	27%
Male Average	24.27	33.27	9.00	37%
TOTAL Average	26.37	34.27	8.40	32%

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Assessment tools

Guidance in pre- and post-test design

1. *Relevance of content to objectives*: does the content clearly address the objectives (e.g. LOs, attitudes, norms)?
2. *Length:* the shorter the better, especially if there are open-ended questions; eliminate redundant questions; pilot test to ensure taking the test would take no more than ½ hour;
3. *Educational level:* ensure that the reading or vocabulary level is at the right level for the youth participants;
4. *Cultural or language adaptation*: questions on sensitive issues must be adapted to local culture in order not be considered offensive.
5. *Avoid overly general or ambiguous questions:* questions that are too general are subject to a variety of interpretations, giving inconsistent results.
6. *Avoid leading or biased questions*
7. *Avoid asking to questions in one*
8. *Mix positive and negative statements* when measuring attitudes or behavior through statements asking respondents to "agree" or "disagree".
9. *Sampling:* use methods to achieve a non-biased representative sample (e.g. random selection or systematic selection).

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- *Split in 4 groups: Romanian, Cypriot, Dutch and Greek!*
- *First 2 groups will work on digital competencies, the other 2 groups on civic competencies...*
- *Brainstorm within your group to answer the question:*

"How would you assess the learning achievements of your student after you taught with MARGs?

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THANK YOU FOR ATTENTION!