THE USE OF REVERSE ENGINEERING CONCEPT TO DEVELOP EDUCATION

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BACKGROUND

In conventional curriculum development, a six-step process includes needs assessment, content determination, goal and objective formulation, educational strategy selection, curriculum implementation, and evaluation (1). Yet, program failures often arise due to inconsistencies between content and assessment. Hence, we advocate embracing Reverse Engineering Principles for improved alignment.

Reverse engineering, a process rooted in analyzing design considerations and fundamental components underlying existing equipment (2), finds application in education when considering expected student performance in specific activities as the equipment. By preemptively defining these performances (step 1 in the figure below) and associated forms of verification (step 2 in the figure below), we gain insight into the fundamental components corresponding to educational environments, content (step 3 in the figure below), and strategies.

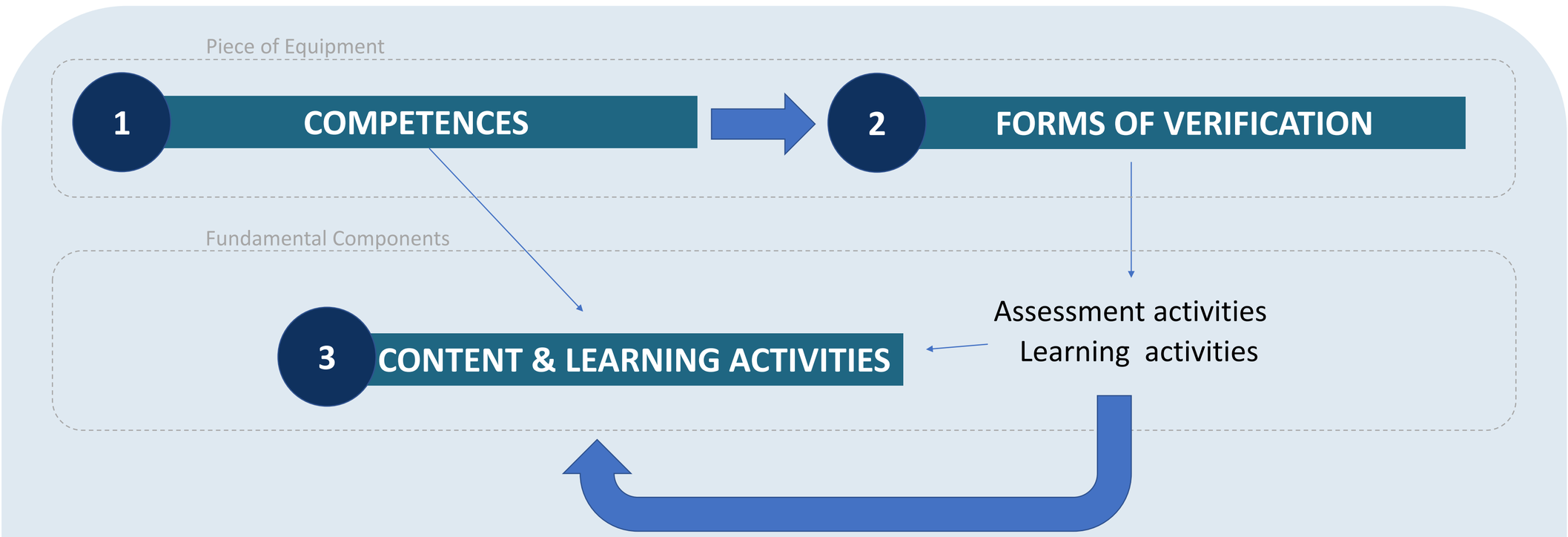
In other words, we define the expected performance and "dismantle" it into fundamental components and design considerations.

PURPOSE & METHODS

This research aimed to pilot the curricular development following Reverse Engineering Principles, employed in a European project focused on curriculum development in Healthy Ageing, by starting the process by the definition of competences and forms of verification, instead of starting by the content (see figure below).

To research the process, we followed the systematic steps of cycle 1 of action research, by first planning the steps, take the action and analyse and reflect on the action. The outputs developed in each steps, were validated in four rounds:

- Round 1 – Competences cluster validation – nominal group method with the consortium
- Round 2 – forms of verification – nominal group method with the collaborators
- Round 3 – structure, content and modules organisation – nominal group method with the collaborators
- Round 4 - structure, programme learning outcomes, content, assessment and modules organisation – nominal group method with the consortium, including the collaboration of students.



1. Competences –analysis and clustering the competences in areas of performance
2. Forms of verification – considering the principle of competency-based education, the experts determined what and how to verify these competences per area of performance. This step was done to contribute to the development of the assessment activities.
3. Content and learning activities - After the definition of the models of verification of competences, was defined the content and learning activities needed to prepare students to acquire the competences and perform at the desired level.

RESULTS

Initially, members of the project had difficulties to stick with the discussion of forms of verification, with frequent detours to discuss content. With a goal-oriented group facilitator, an intrinsic motivation to follow the proposed sequence and an acknowledged advantage of discussing the expected behavior from students, the group implemented the process accordingly to the figure above.

At the end, we achieved a 60 ECTS programme, with four modules (15 ECTS each) where competencies are assessed in practice and real context employing entrusted activities (3), and content is learned based on needs to develop the project.

Most of the programme is developed in contact with practice and adjusted to the respective contexts.

As one of the major competences expected is the ability to implement change in the community towards healthy habits, professionals will require specific competences with sequential processes for innovation.

Starting the discussion by the expected performances and forms of verification facilitated the development of a programme organized as a process for implementation of change and innovation itself. Process models for implementation specify the stages in an implementation process and that is how the curriculum is organized, providing students with a roadmap for the journey of learning but also of intervention in the communities.

IMPORTANCE

As we gained deeper understanding of the fundamental components in relation to the expected equipment (competences and performance), our approach yielded four integrated practice modules enhancing content and learning environment alignment in a competency-based curriculum. This method holds potential value for programs seeking contextualized education. Moreover, this approach allowed for a great consistency among competences, assessment, educational activities and the content across the modules and within them.

(1) Schneiderhan J, Guetterman TC, Dobson ML. Curriculum development: a how to primer. Fam Med Community Health. 2019 Mar 8;7(2):e000046. doi: 10.1136/fmch-2018-000046. PMID: 32148703; PMCID: PMC6910735. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6910735/

(2) Miłkowski, Marcin. (2013). Reverse Engineering in Cognitive Science.

(3) C. El-Haddad, A. Damodaran, H. P. McNeil, W. Hu. 2015. The ABCs of entrustable professional activities: an overview of 'entrustable professional activities' in medical education. Internal Medicine Journal. Vol 46, issue 9. https://doi.org/10.1111/imj.12914

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