

## **EDUNANO Quality Assurance and Quality Control plan**

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The terms quality assurance (QA) and quality control (QC) have often been used either interchangeably or a strong distinction between them has been made as QA being considered process oriented and QC – product oriented. In this document we follow the ISO quality management definitions of QA and QC (ISO Quality Management, 2014). QA includes planned and systematic activities to build confidence among project's partners that they do the right things at the right time and in the right way. The QC is embedded in the QA process to operationally check the quality of the activities.

The EDUNANO QA and QC Plan (QACP) is an internal project's document that describes a set of activities and concrete measures for achieving high quality standard of the project. The EDUNANO QACP provides a common conceptual ground and outlines a transparent frame of reference for the project's partners to arrive at an agreement on and declare a commitment to project quality execution and appraisal. As a dedicated quality document, the QACP elaborates on and complements the information already provided in the project's description.

The main questions that the EDUNANO QACP Plan addresses is as follows: How can we guarantee high quality of all project's activities and products? What are the criteria to guide high quality performance of the project team?

### **EDUNANO project definition**

The EDUNANO project is aimed at transferring knowledge and skills between EU higher education institutions and institutions in Israel and between Israeli institutions to restructure and modernise the curricula on nanotechnology through developing, testing and certifying e-learning courses in high education, corporate training and teacher-training.

### **Background**

The EDUNANO QACP integrates three concepts: quality, curriculum development and software development. In the preparation of the EDUNANO QACP a number of quality management approaches have been taken into account, namely: (a) European reference frameworks such as Qualifications of the European Higher Education Area and Standards

and Guidelines for Quality Assurance in the European Higher Education Area; (b) curriculum development for high quality; (c) software engineering methodologies including qualitative standards such as ISO/IEC 9126-1 and Software Quality Assurance within Capability Maturity Model Integration); and (d) PRINCE 2 (**PR**ojects **IN** **C**ontrolled **E**nvironments), that is a wide spread and highly referred corporate project management methodology.

As a software development project, which will develop an online learning environment, EDUNANO conforms to the recent developments in the software engineering design such as rational unified process, extreme programming and participatory design. While the specific details of these methodologies vary, they share the basic idea of a progressive, spiral refinement through a cyclical prototype development and their reliance on stakeholders involvement in the design and evaluation of the project's products (Holtzblatt, Wendell, & Wood,2005; Kuniavsky, 2003)

As a curriculum development project, EDUNANO includes evaluation not as a single phase, typically conducted in the end of the process but rather as cutting across other phases (needs assessment, design, development and implementation). The modern curriculum development approaches, similar to software design methodologies, also implement the ideas of participatory design and prototype development (Marsh & Willis,1995). The fact that curriculum and software development approaches adopted in EDUNANO share similar methodological background is a basis for enhancing the quality of the project products under the overarching concept of design-based research and development.

The software quality standard ISO 9126-1 proposes quality indicators (functionality, maintainability, usability, efficiency, reliability, portability) that EDUNANO adapts to the specific needs of the project. They will be applied during the development of the web-based learning environment.

Although helpful, the most of the quality approaches referred to are too general to be applied directly as quality measures to EDUNANO. The EDUNANO QACP must be operational, which means including concrete project-specific standards and measures.

### **EDUNANO quality assurance and quality assurance control activities**

This section discusses a set of quality assurance activities and quality controls embedded in it which are mainly focused on guiding the project partners in achieving high quality products. Not all quality assurance activities and controls are provided in the EU documents, nor are they explicitly discussed in the other project' documents. For convenience the activities are

grouped thematically after the project's work packages. When included the QC activities are referred to explicitly.

### **Project Management**

1. Describe clearly all project activities, deliverables, milestones, time frames, way of reporting, and partners' responsibilities. All these need to be discussed by partners and accepted by project's Steering Committee.
2. Establish the project's Steering Committee with a representative from each partner organization. The Steering Committee works closely with the coordinator for the operational management of the project (See project proposal for details).
3. The project's Steering Committee establishes a procedure and a set of criteria for evaluating the deliverables. There should be two peer-reviews of each deliverable according to a predefined evaluation schema. This is a quality control measure.
4. Set up an easy to use web-based project management environment with the necessary functionality, tools and services for managing the project. The system is checked before being opened for partners and EC agency. The system is reliable and partners feel comfortable with it. A Help system and written Guide are available.
5. Describe briefly "What if" scenarios and draw contingency measures to deal with potential risks. Examples are: What if recording of laboratory practices is not possible. What if the principles of performance support are not implemented in the course design?; What if a partner is overspending? What if a university authority does not want to sign the agreement for a sustainable development of the nanotechnology curricula? The Project Steering Committee collects the scenarios generated by partner institutions, clusters and prioritizes them before suggesting measure to deal with the risk situations.

Alternatively, apply the SWOT analysis or the Force-Filed Analysis. Determine with the SWOT analysis the strengths and opportunities that can make the project a success or weaknesses and threats, that would prevent from it. With the force-field analysis define the forces that work for the success of the project and forces that would make that problematic.

6. Draw a conflict resolution procedure. It includes a list of possible conflict situations, steps and responsibility of the parties involved.

### **Needs, domain and job analyses**

1. Communicate clearly and coordinate effectively the partners' needs analysis tasks. Use predefined templates.
2. Select appropriate methods for the needs analysis data collection. Examples are: survey through questionnaires; interviews with teachers, students, employees from enterprises and educational managers; focus group with partners representatives; interview with experts; review national documents on nanotechnology strategic development; technological forecast.
3. Conduct job analysis in nanotechnology enterprises. Identify problem situations in the enterprises/research centres that can serve as cases and reference situations in the design of the high education courses.
4. Conduct domain analysis for trends in nanotechnology.
5. Investigate trends in labour market and technology development.

#### **Curriculum development and instructional design**

1. All course syllabi implement the instructional design approach of performance support system. Make an internal informal training with the project's partners either face-to-face or online to explain the principles of performance support system.
2. Prepare a competence matrix for each course. Formulate competences as expected outcomes in terms of behavior action and measurable standards to achieve.
3. Describe all courses using a specific template (learning outcomes, entry requirements, sequence of tasks, support for tasks, assessment methods, ECTS). The courses implement the idea of performance support. There is a consistency between the learning objectives, the performance support strategy and the assessment methods.
4. Peer review of the courses. All partners are involved in critical and constructive feedback of the course descriptions. This is quality control activity.
5. All syllabi refer to European Credit Transfer System and European Qualification Framework (EQF).
6. The curricula as a whole reflects the multidisciplinary character of nanotechnology.
7. Check existing Open Educational Resources (OER) and MOOC in nanotechnology to eventually include content or tasks from there or simply make a reference to OERs and MOOCs resources.

#### **EDUNANO web-based learning environment and content repository**

1. The environment provides all necessary technical affordances for supporting performance support system approach.

2. The environment conforms to technical specifications (“build the product right”). This is quality control check.
3. Test the utility and usability of the NANOEDU learning environment initially with the consortium partners. This is a quality control measure.
4. Test the utility and usability of the web-based learning environment with at least five students or five enterprises/research centres employees at the partner institutions concerned (“build the right product”). Prepare Evaluation Script (purpose, background, informed consent, tasks, interview questions and prompts, hints for conducting interview (e.g avoiding leading questions). Use a variety of methods: software-walkthrough, interview, usability questionnaire, heuristic protocol. This is a quality control action.

### **Implementation of the courses and formal field trials**

1. Provide sufficient time (at least two semesters) for the field user trials.
2. Draw a brief plan to guide implementation of the courses and field trials. The plan describes the research methodology, sampling, and measurement instruments. Involve different types of participants (students, employees, teachers, curriculum designers and educational managers), different data collection methods (questionnaire, interview, software-walkthrough, observation, performance test). Include where possible a control group to compare the results. This is a quality check.
3. Discuss the plan with the project partners. (also a quality check).

### **Dissemination and sustainability**

1. Use various channels for distributing the project results: a project web portal, information on the partner institutions web sites, conferences’ presentations and workshops, publications in high impact journals, professional networks, social networks.
2. Try to present the project’s results in high profile conferences (an acceptance rate up to 25 %). This is a quality control measure.
3. Try to publish at least two papers in an ICI (indexed) journals (formal measures such as 5-years impact factor of at least 2.5 and an influence score of 0.5). This is a quality control action.
4. Use social media to promote the project’s results (e.g LinkedIn Higher Education group).
5. Implement courses in the regular university or enterprises training programmes.
6. Write a business plan for sustainability.

7. Sign an agreement between partners for further cooperation.
8. Design a portal for courses in nanotechnology in Israel. The portal also serves as a community of practice environment to support knowledge sharing.
9. Maintain the project web site after the project's end.
10. Extend the cooperation between partners to include joint supervision of PhD students.

### **Attitudes and culture**

The project's partners develop attitudes and establish a culture for delivering high quality products and processes. The project's partners have the ambition and work to make EDUNANO an outstanding project. The project's partners behave as a highly effective team.

### **Consortium vision on actions that lead to the project's success**

The list of activities that are supposed to assure high quality of the project, as presented in the previous section, are derived from some projects in the past and are researcher-driven. This is a top-down approach for defining the set of QA and QC activities. A complementary and maybe more effective (bottom up) approach would be to support the EDUNANO consortium members themselves to define in an objective way their shared vision on actions that are needed to assure a high quality project. The approach proposed to bring into such a result is Group Concept Mapping (GCM). The external evaluator is a well-known expert in that methodology, which presents a good opportunity for the project to benefit from his expertise<sup>1</sup>. In the next section a brief description of the GCM is provided followed by some examples as what kinds of results can be expected. The examples are taken from other projects investigating different issues. The bottom line is that the methodology could be applied any time a group of experts needs to come up with a common understanding and shared vision on a challenge it is facing.

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<sup>1</sup> Some selected publications on GCM applied in different domains: Stoyanov, S., Spoelstra, H., Bennett, D., Sweeney, C., Van Huffel, S., Shorten, G., O'Flynn, S., Cantillon-Murphy, P., O'Tuathaigh, C., & Burgoyne, L. (2014). Use of a group concept mapping approach to define learning outcomes for an interdisciplinary module in medicine. *Perspectives in Medical Education*. DOI 10.1007/s40037-013-0095-7; Wopereis, I. G. J. H., Stoyanov, S., Kirschner, P. A., Van Merriënboer, J. J. G. (2013). What makes a good musical improviser? An expert view on improvisational expertise. *Psychomusicology: Music, Mind, and Brain*, 23, 222-235. doi:10.1037/pmu0000021; Janssen, J., Stoyanov, S., Ferrari, A., Punie, I., Pannekeet, K. & Sloep, P. (2013). Experts' views on digital competence: Commonalities and differences. *Computers & Education*, 68 (2013) 473–481; Stoyanov, S., Boshuizen, H., Groene, O., van der Klink, M., Kicken, W., Drachsler, H., & Barach, P. (2012). Mapping and assessing clinical handover training interventions. *British Medical Journal Quality & Safety*, 21, i50-i57. doi:10.1136/bmjqs-2012-001169; Stoyanov, S., Hoogveld, B., & Kirschner, P.A. (2010). Imaging future learning: mapping major changes to education and training in 2025. *eLearning Papers*, special edition. European Commission, 9-23.

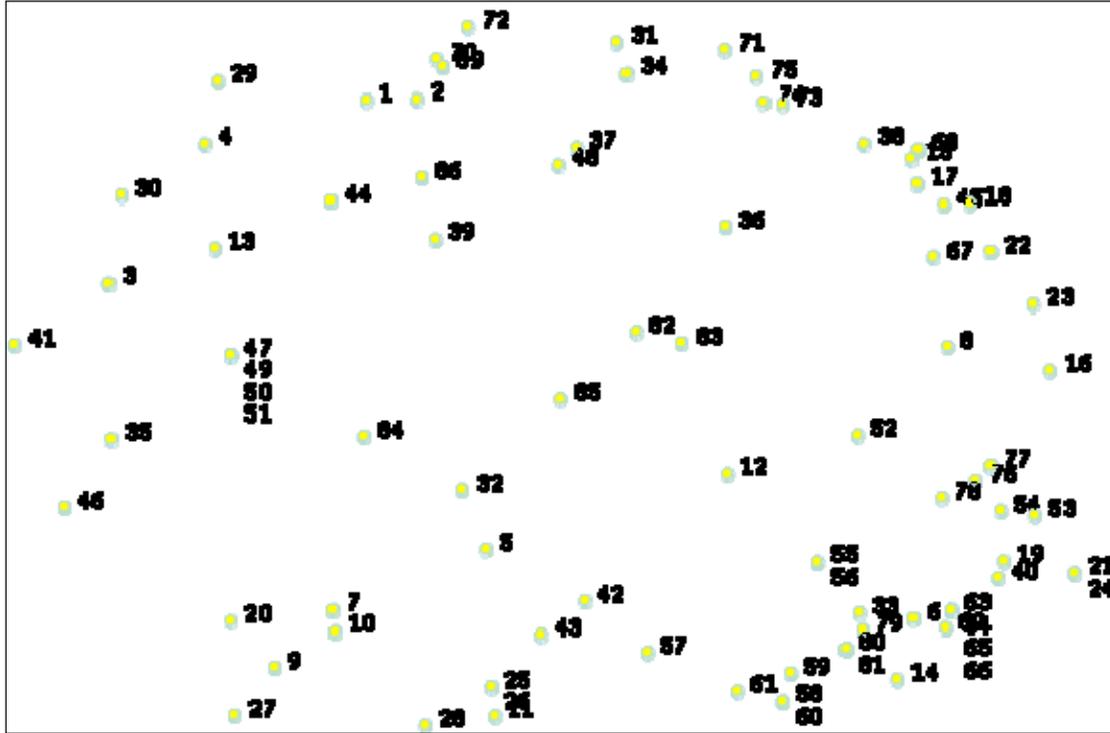
## **Group Concept Mapping**

Group Concept Mapping (GCM) is a structured approach that facilitates a group of experts to come up with a common understanding about a particular issues (e. g. actions that are needed to make the project successful). The approach includes a number of activities that most of the people are used to (generating, sorting and rating of ideas). There are two distinguishing characteristics of the methodology when compared to similar techniques such as Delphi, Affinity diagram, interviews and questionnaires. The first one is that the methodology applies some advanced multivariate statistics such as multidimensional scaling and hierarchical cluster analysis. Although the participants work individually and independently of each other, creating different number of groups of ideas and putting different ideas in a group of statements, it is these statistical techniques that go across and quantitatively aggregate individual inputs of the participants to identify emerging patterns from the data. The second salient characteristic of the methodology is visualization. The results are presented as three types of visualization: conceptual maps (not to be confused with classical concept or mind maps), pattern matches and go-zones that makes the interpretation easy. The participants only need to generate ideas completing a focus prompt (“One particular action needed to make the project successful is...”), sort them into groups and rate them on some values, e.g importance and feasibility. If the consortium agrees on using GCM, the external evaluator will set up a web-based environment for individual online idea generation, sorting and rating of ideas and he will conduct the analysis. Upon creation of a username and password the participants will be able to return to the environment as many times as they need. Altogether the three activities will take no more then 2.5 hours in a period of 3 weeks. See Appendix A for the kind of outcomes that can be expected from the GCM study.

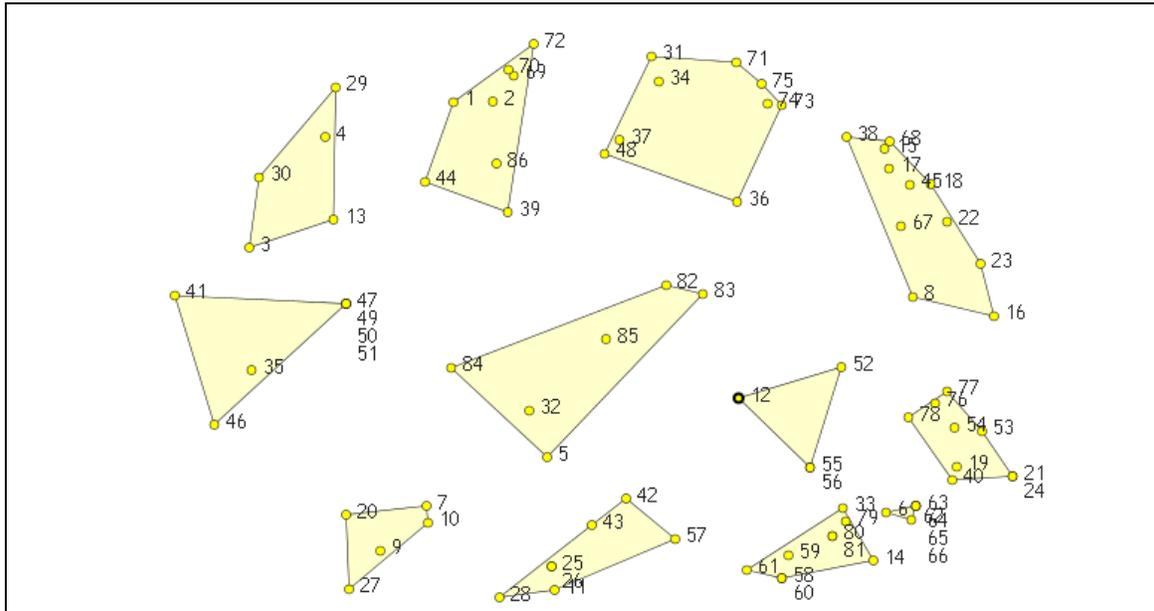
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- Kuniavsky, M. (2003). *Observing the user experience. A practitioner's guide to user research*. San Francisco, CA: Morgan Kaufmann.
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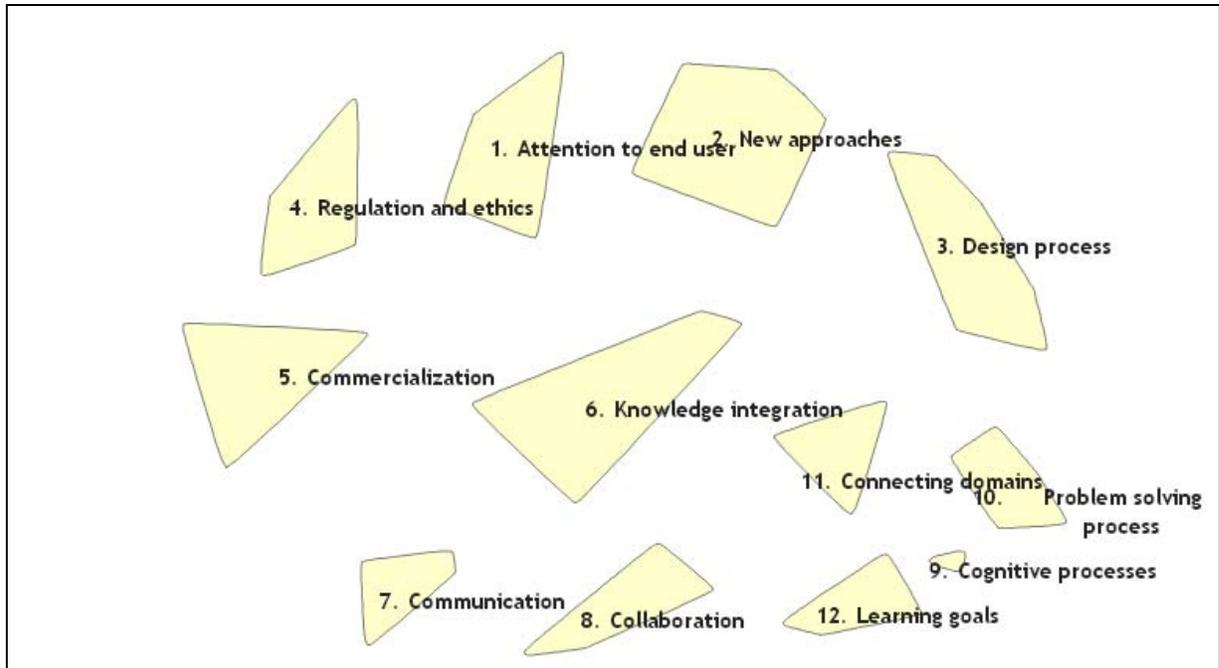
## Appendix B. Kinds of GCM outcomes



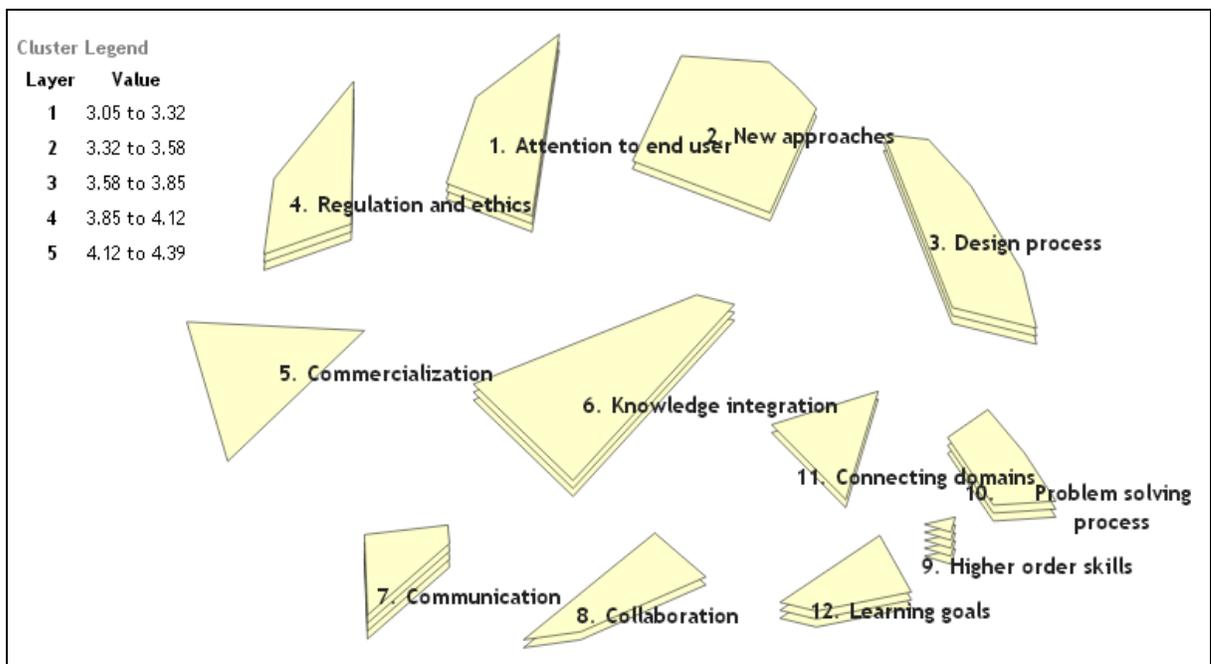
Point map (points are ideas generated)



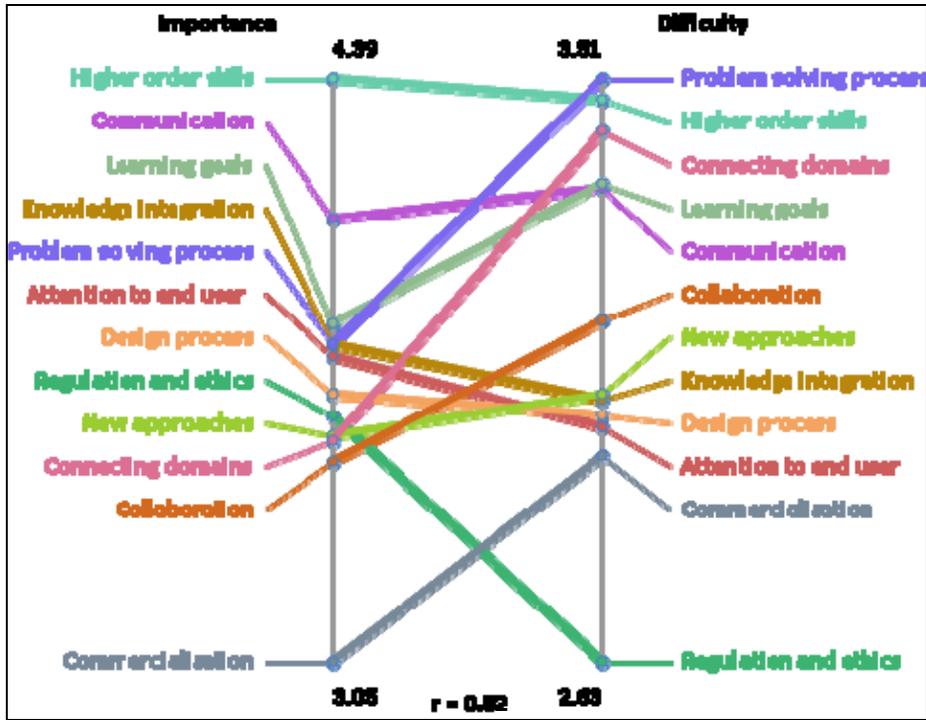
Cluster map (group of ideas as suggested by hierarchical cluster analysis)



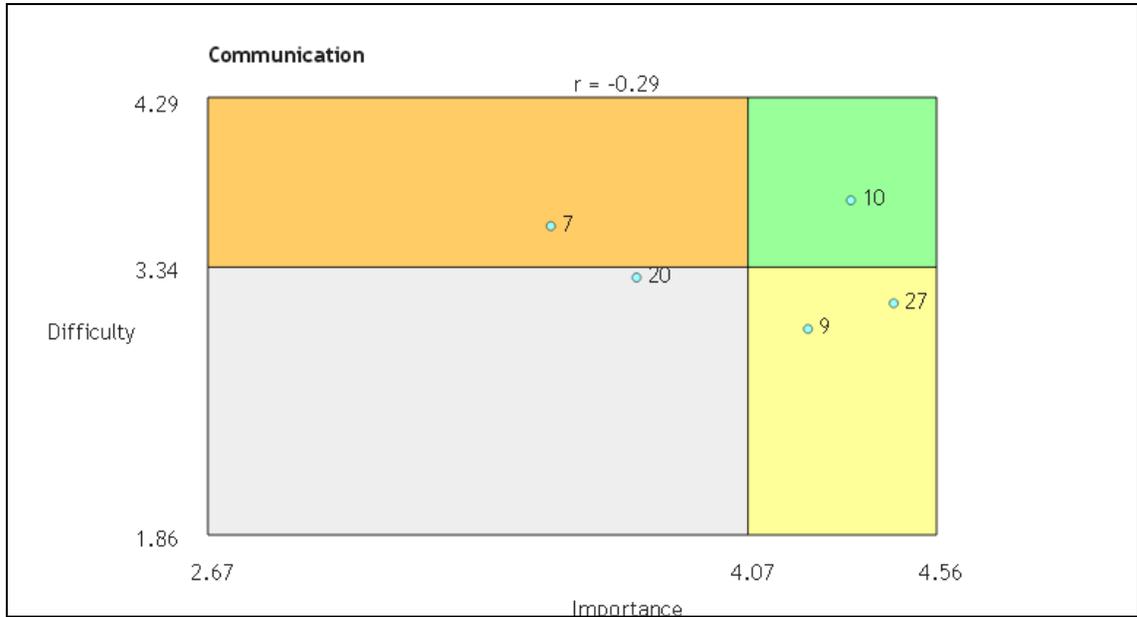
Cluster map with labels



Rating map



Pattern match



Go-zone of one of the clusters