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Mapping Major Changes to Education and Training in 2025

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PREFACE

The Europe 2020 strategy acknowledges that a fundamental transformation of education and training is needed to address the new skills and competences required if Europe is to remain competitive, overcome the current economic crisis and grasp new opportunities. However, to determine how education and training policy can adequately prepare learners for life in the future society, there is a need to envisage what competences will be relevant and how these will be acquired in 2020-2030.

To contribute to this vision-building process on ways of addressing emerging competence needs, JRC-IPTS[1] in collaboration with DG Education and Culture launched a foresight study on "The Future of Learning: New Ways to Learn New Skills for Future Jobs", in 2009. This study continues and extends work done in 2006-2008 on "Future Learning Spaces" (Punie et al., 2006, Punie & Ala-Mutka, 2007, Miller et al., 2008). It is made up of different modules which will be completed during 2010 and 2011. The modules will include a series of stakeholder consultations, involving different target groups ranging from policy makers, and scientists to educators and learners.

The overall objective of the study is to contribute to the development of imaginative visions and scenarios of the future of learning in order to support priority setting for education, training and skilling policies (http://is.jrc.ec.europa.eu/pages/EAP/ForCiel.html). A first series of expert consultations have been commissioned to a consortium led by TNO of the Netherlands with partners at the Open University of the Netherlands and Atticmedia, UK. As a first step in this series of vision building exercises, a targeted and structured stakeholder consultation was undertaken by staff at the Open University of the Netherlands, involving a focus group of 13 external experts from different fields, including social sciences, education, technology and also industry. This report presents the findings of this consultation process, which employed the Group Concept Mapping (GCM) methodology to come up with a map of thematic clusters indicating major changes to be expected to education in the next 20 years.

[1] IPTS (Institute for Prospective Technological Studies) is one of the 7 research institutes of the European Commission's Joint Research Centre

EXECUTIVE SUMMARY

This report presents the findings of a structured and targeted expert consultation process on the Future of Education and Training, employing the Group Concept Mapping methodology.

Methodology

This intensive process involved a focus group of 13 experts at three stages, i.e. in (1) gathering, (2) clustering and (3) rating insights on major changes to education in 20 years. The experts came up with a total of 203 ways to complete the trigger statement "One specific change in education in 20 years will be that: …". Each expert then arranged the changes foreseen in different thematic clusters and rated them for importance and feasibility.

The vast amount of data thus generated was subsequently aggregated and analysed. To depict the emerging structure in the data, multidimensional scaling and hierarchical cluster analysis were applied. Based on the experts' sorting activity, each statement was placed on a map, reflecting its proximity or distance to the other statements. Based on the position of the statements and the clusters proposed by experts, the statements were subsequently clustered into 12 groups, which were labelled using titles suggested by the experts (Figure 1).

Findings

A set of **12 thematic clusters** emerged, which summarize what the experts consider will be the main changes to education and training over the next 10 to 20 years. These comprise: technology in education; tools and services for enhancing learning; open education and resources; assessment, accreditation and qualifications; globalisation of education; roles of institutions; individual and profession-driven education; the role of the teacher; life-long learning; formal education goes informal; the individual and social nature of learning; and epistemological and ontological bases of pedagogical methods.

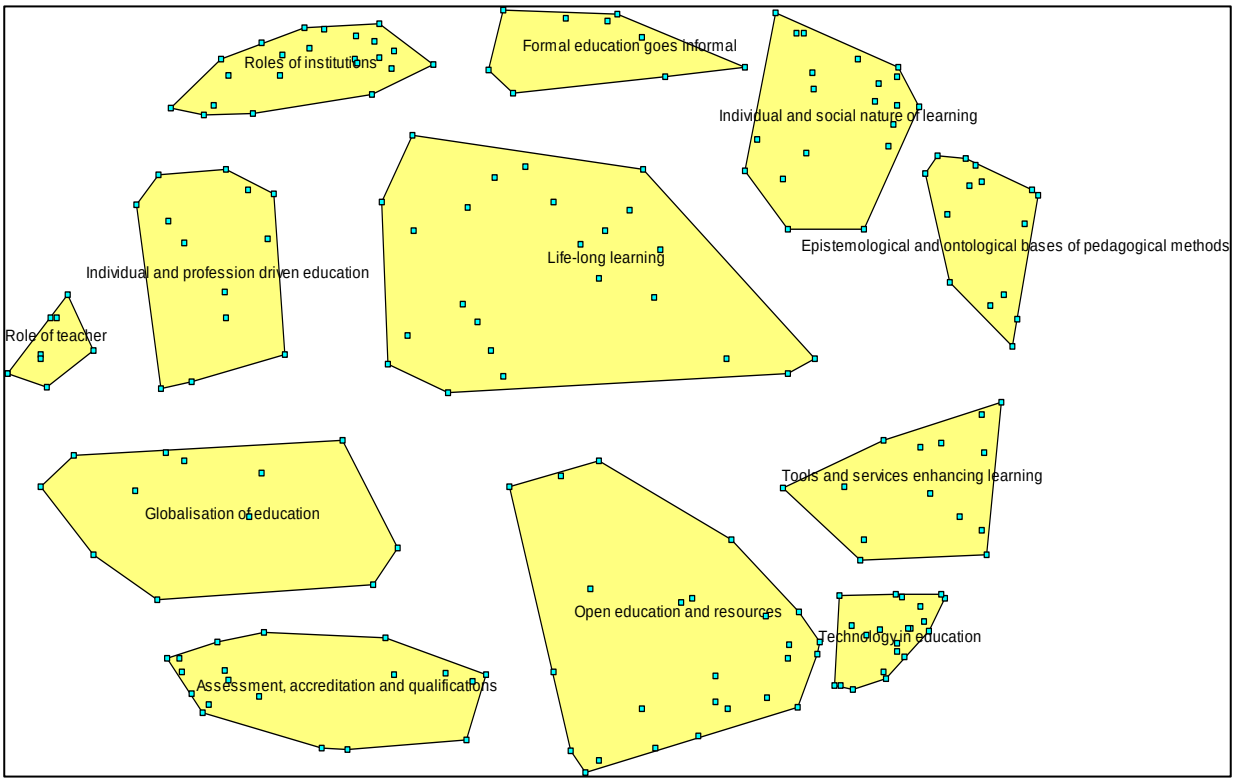

Figure 1: The Landscape of the Future of Learning

Some of these clusters are more technology-oriented: i.e. 'technology in education', and 'tools and services for enhancing learning'. 'Open education and resources' acts as a bridge between more

technology-oriented clusters and the clusters 'globalization of education' and 'assessment, accreditation and qualifications', indicating that, according to the experts, technology facilitates the access to education and educational resources. The clusters 'role of teachers', 'role of Institutions', 'Individual and profession-driven education' and 'formal education goes informal' suggest a shift in the responsibility for acquiring competences from the institutional to the individual level. Finally, the remaining two clusters ('individual and social nature of learning' and 'epistemological and ontological bases of pedagogical methods') are learning-oriented. These focus on issues related to cognitive and social aspects of learning as a basis for the design of effective, efficient and appealing learning environments.

One of the most important findings that emerges from the sorting is the central role of the **'life-long learning' cluster**, indicating its vital role for the future of learning. This cluster is a connection point for all other clusters, suggesting that many of the envisaged changes to learning strategies and pathways are related to the fact that, according to the experts, in the future, skills and competences will be acquired in a life-long learning continuum.

In the last step in the Group Concept Mapping approach, statements were rated **for importance and feasibility**, revealing some of the expected changes as being of particular importance. These include:

- The nature of learning will become more learner-centred, individual and social;
- Personalised and tailor-made learning opportunities will address individual and professional training needs;
- Innovative pedagogical concepts will be developed and implemented in order to address, for example, experiential and immersive learning and social and cognitive processes;
- Formal education institutions will need to flexibly and dynamically react to changes and offer learning opportunities that are integrated in daily life; and
- Education and training must be made available and accessible for all citizens.

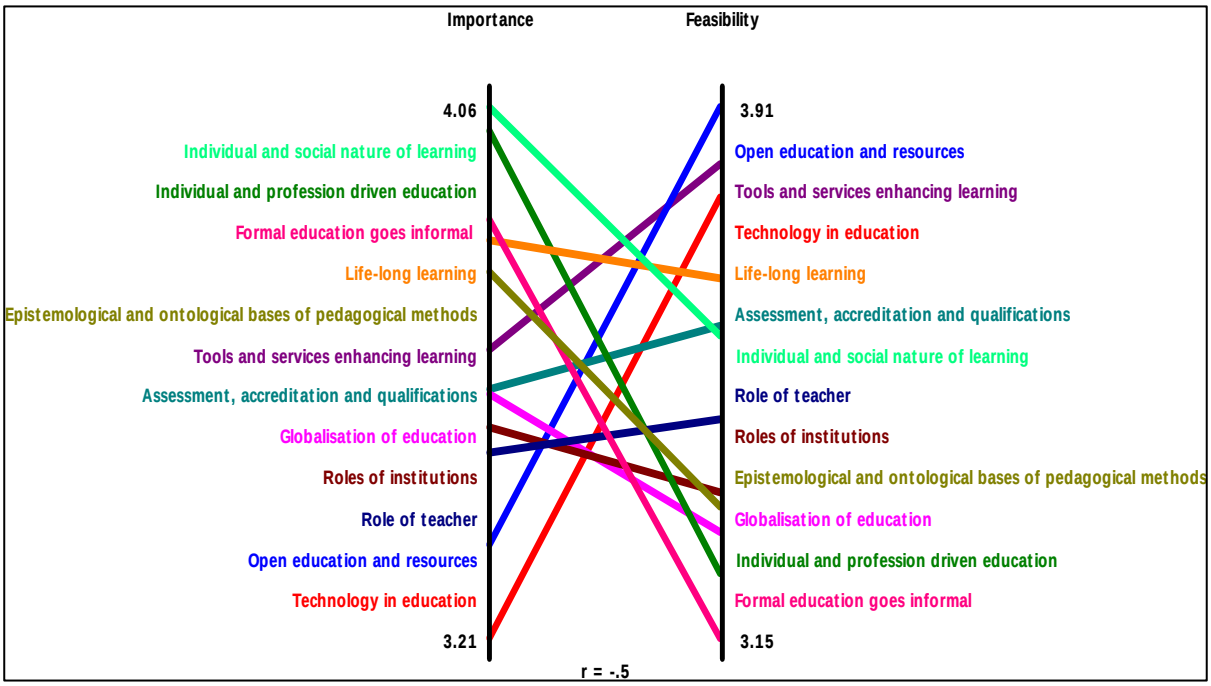

Figure 2: Thematic clusters and their ratings on importance and feasibility, on a scale from 1 (high) to 5(low)

When comparing the cluster ratings on importance and feasibility (Figure 2), it becomes clear that, while the experts are optimistic about the development of technology-enhanced learning opportunities, they are sceptical about the feasibility of implementing learner-centred approaches in formal education and, in general, the ability of formal education systems and institutions to keep pace with change and become more flexible and dynamic.

This general tendency is confirmed and further specified by a detailed look across clusters at the 57 statements that score higher than average on importance and, at the same time, lower than average on feasibility, thus indicating **issues that will need particular attention by policy-makers**. The most prominent of these are:

- the need to ensure appropriate, accessible and affordable education that caters for the learning needs of every citizen, irrespective of age;
- the importance of implementing pedagogies that focus on transversal competences, such as strategic, problem-oriented, situational thinking, creativity and learning to learn;
- the need to align technology and pedagogy to create participative learning environments which enable high quality learning experiences that keep participants interested and motivated;
- ways to integrate learning into the workplace, community and home;
- ways to adapt assessment strategies meaningfully to the manifold ways in which people actually learn; and
- the need to address the changing role of teachers as learning mediators and guides, enabling them to become lifelong learners themselves.

The aim of this report is to share the technical results of the Group Concept Mapping consultation as a contribution to the broader project on the future of learning. The interpretation and further integration of these results into the vision-building process on the future of learning will be done in subsequent publications.

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1. INTRODUCTION

This report presents the results from a Group Concept Mapping study conducted at the Open University of the Netherlands as a contribution to the IPTS project 'Future of Learning: New ways to learn new skills for future jobs'. Thirteen experts with either technical or social sciences educational backgrounds, mostly from academia and Europe, participated in the study. They were asked to first generate ideas individually about the future of education by reacting to the trigger statement "One specific change in Education in 20 years will be that: …". The resulting ideas were then sorted into groups according to similarity in meaning and rated on two scales: importance and feasibility. Multidimensional scaling and hierarchical cluster analysis were applied to depict emerging structure in the data.

203 unique ideas were generated, which is a very high number. It exceeds the number of ideas produced in any other GCM study. This effect might be explained by the sample of experts, the instructions provided and the openness of the topic ("The future of learning") in general. Sorting and rating were time consuming activities, but not difficult for the participants from a conceptual point of view. As concerns the data analysis, in contrast to other similar techniques (e.g. affinity diagram or card sorting), GCM applies rigorous statistical techniques such as multidimensional scaling and hierarchical cluster analysis to identify emerging structures in the data. To facilitate the interpretation of the data further, visualisations employing the Concept System (2010) software were used.

1.1 Background

Group Concept Mapping (GCM) applies a structured participative approach to facilitate groups of experts to arrive at a consensus about a particular issue, e.g. characteristics of learning in 2020. (Kane, 2008; Quinlan, Hall, Tuzzio, McLaughlin, Wagner, Brown, &. Yabroff, 2008; Stoyanov, & Kirschner, 2004; Trochim, 1989; Wopereis, Kirschner, Paas, Stoyanov, & Hendriks, 2005). The analysis depicts, in the form of thematic clusters, the experts' common understanding of the issue under consideration. GCM uses a structured facilitative multi-step approach including a number of simple and intuitive activities such as idea generation, and sorting and rating of ideas. The research method, by its "hybrid" nature, can easily integrate any qualitative method for data collection and analysis, such as individual interviews, surveys, focus groups or Delphi method. While the methodology benefits from the strengths of existing text-analysis techniques such as grounded theory and content analysis, it mitigates some of their weaknesses: i.e. relying on researcher-driven classification schemes, interdependence between coders, and weak validity and reliability assessments. GCM uses the original intact respondent statements as units of analysis to help participants to sort and then quantitatively aggregate their contributions, so that structures in the data emerge.

1.2 Method

1.2.1 Participants

Thirty educational experts were personally invited to take part in the FORLIC GCM study. Eighteen accepted the invitation and finally thirteen of them participated in all phases of study: idea generation, sorting and rating. The group represented a balanced sample of educational expertise and professional orientation and included experts with either social sciences or technical sciences educational backgrounds. Eleven experts came from European countries located in different geographical zones. Two experts represented institutions from the US. Eleven experts were academics and two were from industry.

1.2.2 Procedure

GCM consists of two phases: idea generation, and sorting and rating ideas.

Idea generation

Idea generation requires the participants to individually generate ideas in response to a focus (trigger) statement. The focus statement was as follows:

> We all have the feeling that education in 20 years time will have to be different from education today. Education then will possibly deal with a new set of skills and competences, new curricula or types of curricula, innovative ways of learning and assessment, different roles for teachers and educational institutions, different impacts of technology, to mention just a few of the possible differences. We ask you to generate statements about your thoughts about education in 20 years, and to do this using the following format:
>
> **One specific change in education in 20 years time will be that: …**

Then we gave some examples to better illustrate what kind of outcomes the experts were expected to provide:

- *Learning will not be restricted to traditional educational institutions.*
- *Teachers will become mediators between students, knowledge and technology.*
- *Learning will be much more driven by internet-based social networking.*
- *Life-long learning will be the norm.*
- *Class size will not matter.*
- *Learning methods will take into account cognitive structures and processes.*

To help the experts to generate many and various ideas about the future of education, we provided them with the following instructions:

> Try at first to generate as many statements as possible. The more ideas that you generate, the greater the chance of selecting your best ideas. Postpone and withhold any judgments; all ideas have value and may lead to better ideas. Do not block your idea generation with a premature evaluation (no idea is stupid). Try to generate "out–of-the-box ideas". Once you are no longer able to generate new ideas you can begin to elaborate, combine and evaluate the relevance of generated ideas. Watch the clock. A little time pressure is good for brainstorming, so decide upon a maximum time for brainstorming, say 10 to 15 minutes, and stick to it.
>
> Try to include only one idea per statement. It's better to have several statements, each expressing one idea, than one statement describing many ideas.
>
> Please note: GCM brainstorming differs a little from classical brainstorming, because it is not "anything goes" but rather a targeted exercise of eliciting all possible ideas and issues in response to the context and the format of the brainstorming focus, namely:
>
> **One specific change in education in 20 years time will be that: …**

As a result of the idea generation phase, the experts generated 203 unique ideas in response to the focus statement. Practice suggests that if the number of ideas exceeds 150, a pre-selection by a small group of annalists is needed to assist with the sorting and rating (Trochim, 2007). However, we decided not to apply a pre-selection procedure for two reasons: (a) the participants in this study were experts in the domain; and (b) it did not make much sense to invite experts and then do the job for them. It would imply the researchers' biases, thus affecting validity of the study.

Sorting and rating of ideas

The ideas were randomly shuffled and the final list was sent back to the experts for a first sorting and rating according to following separate instructions for the two idea structuring activities. The instructions for sorting contained the following standard guidelines, provided with a sorting recording sheet (Concept System, 2004):

1. Group the statements for similarity in meaning (in a way that the statements make the most sense to you);
2. Arrange the statements in a way that feels best (no right or wrong grouping);
3. Place each statement in one group only;
4. Place each statement somewhere;
5. Place a statement in its own group if it seems unrelated to the other statements (do not have a group of statements called 'miscellaneous');
6. Once the groups have been sorted, pick any one group of statements and write a short phrase or title describing that group's content.

We asked the participants to rate the statements on two scales: importance and feasibility. The instructions given were also standard, and were provided with the rating recording sheet:

> Please try to rate each of the statements on a 1-to-5 scale of importance and feasibility. For importance: 1 = Relatively Unimportant; 5 = Extremely Important. For feasibility: 1 = Least Feasible; 5 = Most Feasible.
>
> When you rate the statements, try to use the full range of ratings values (e.g. 1 to 5).

The last sentence in the rating instructions was included to avoid the expected mindset that all ideas are important as long as they have been generated by experts. The emphasis here was on relative rather than absolute rating.

1.3 Analysis

Apart from the traditional descriptive statistics, the GCM approach applies some specific types of analyses such as multidimensional scaling (MDS) and hierarchical cluster analysis (HCA). The input for the multidimensional scaling is the creation of a total square similarity matrix based on the outcomes of the sorting exercise by the participants. The matrix is binary and symmetrical, each entry displays the number of experts who grouped together the corresponding pair of statements. The combined matrix combines the individual matrices of the participants. An individual matrix consists of as many rows and columns as there are statements. A cell indicates whether two statements are grouped together or not. '1' in the cell indicates that the two statements are sorted together by the participant, '0'that they are not.

MDS transforms the total square similarity matrix into a map depicted as a coordinated matrix. From the coordinates, MDS can compute the distances between all pairs of statements (points) and can show this as a matrix of distances between points. Figure 3 shows the results of the MDS analysis performed on the data collected from the expert-sorting. Each point represents one of the 203 statements generated. The closer the statements are to each other, the more similar in meaning they are, which also means that more people sorted these statements together.

A reasonable question would be how accurately the point map represents the original similarity input matrix. The extent to which each of the distances between the statements on the map deviates from the values of the total similarity matrix, which is used as input to the map, is measured with the "stress index" (Kruskal & Wish, 1978). In principle, the lower the value of the stress index is, the better the overall fit between the map and the input matrix. A meta-analytical study across a broad range of concept mapping projects indicated that around 95% of concept mapping projects would

produce a stress index value ranging between 0.205 and 0.365. The stress value of the FORLIC project GCM study is 0.355, i.e. in the same range. It has to be noted, however, that FORLIC is the first foresight study to apply GCM. Predicting the future of education brings more complexity to the data and perhaps increases the variability in the way people group statements.

Figure 3. The Future of Education point map resulting from MDS analysis

1.3.1 Hierarchical cluster analysis

The hierarchical cluster analysis applies Ward's agglomerative algorithm and uses the values of the coordinates of the two dimensional MDS to partition the statements on the map in areas which are contiguous but not overlapping with each other (Trochim, 2007). Ward's hierarchical cluster analysis was chosen because it is more appropriate than other hierarchical cluster analyses for interpreting distance data. It uses the coordinate values of the MDS rather than the similarity matrix. This is especially useful when deciding on the number of clusters. The procedure for determining the number of clusters in the FORLIC GCM applies the heuristic called "20-to-5", which is based on the fact that most of the participants in GCM projects make between 5 and 20 clusters. We began with the 20-cluster solution, checking at each step whether the solution from the merging of clusters made sense, until we arrived at the 5-cluster solution. We recorded all our judgements ("yes" or "no") about merging of clusters and, after finishing the procedure, we looked only at the few "yes" judgements for a deeper analysis of the clusters' content. To take decision, we also looked at the bridging/anchoring values of the statement in a particular cluster. The bridging/anchoring statistics have a value between 0 and 1. A low bridging/anchoring value means that more people have grouped the statement together with others in its vicinity. Statements with low bridging / anchoring value better represent the meaning of a particular cluster's content than those with a higher value. This analysis concluded that the 12-cluster solution fits the FORLIC data in the best possible way. Figure 4 presents this solution. In addition, we tried to identify the label which best reflects the content of a particular cluster.

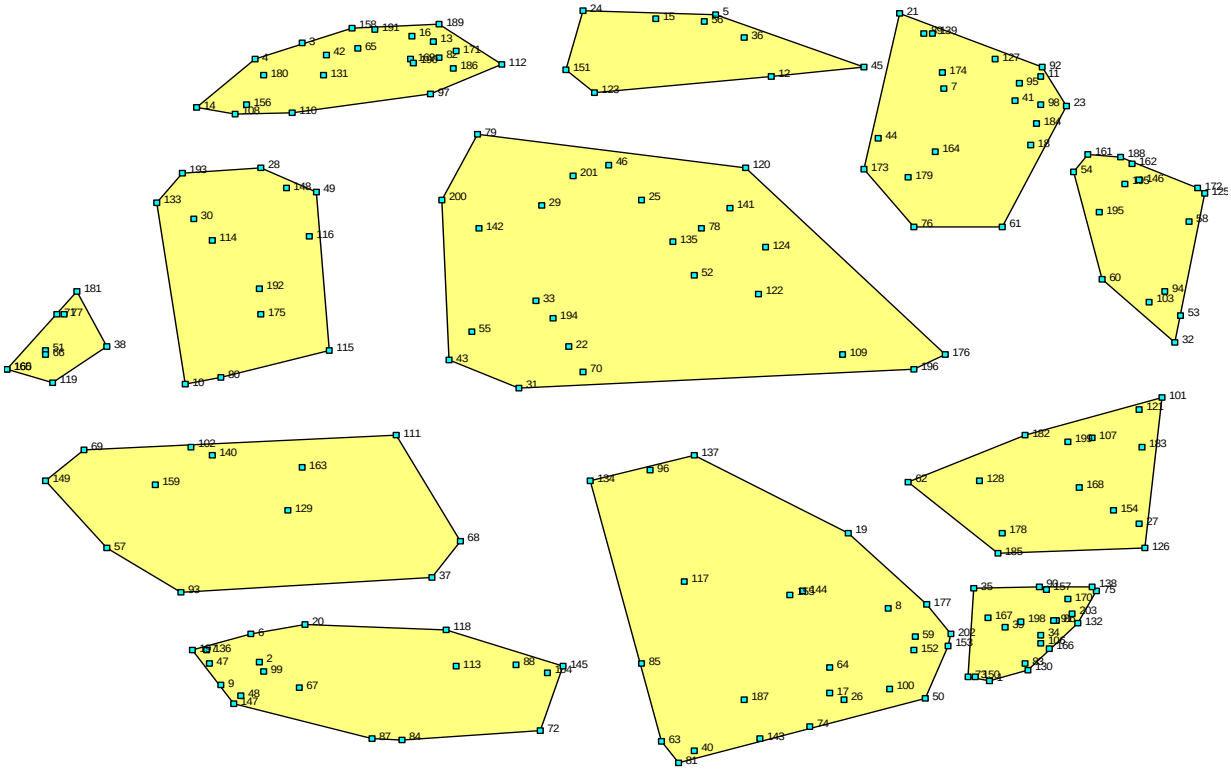

Figure 4. The 12 cluster solution

We applied two criteria: (a) statements with low bridging/anchoring value better represent the content of a cluster than statements with high bridging value; and (b) analysis of the proposed labels by experts. Figure 5 presents clusters with their labels.

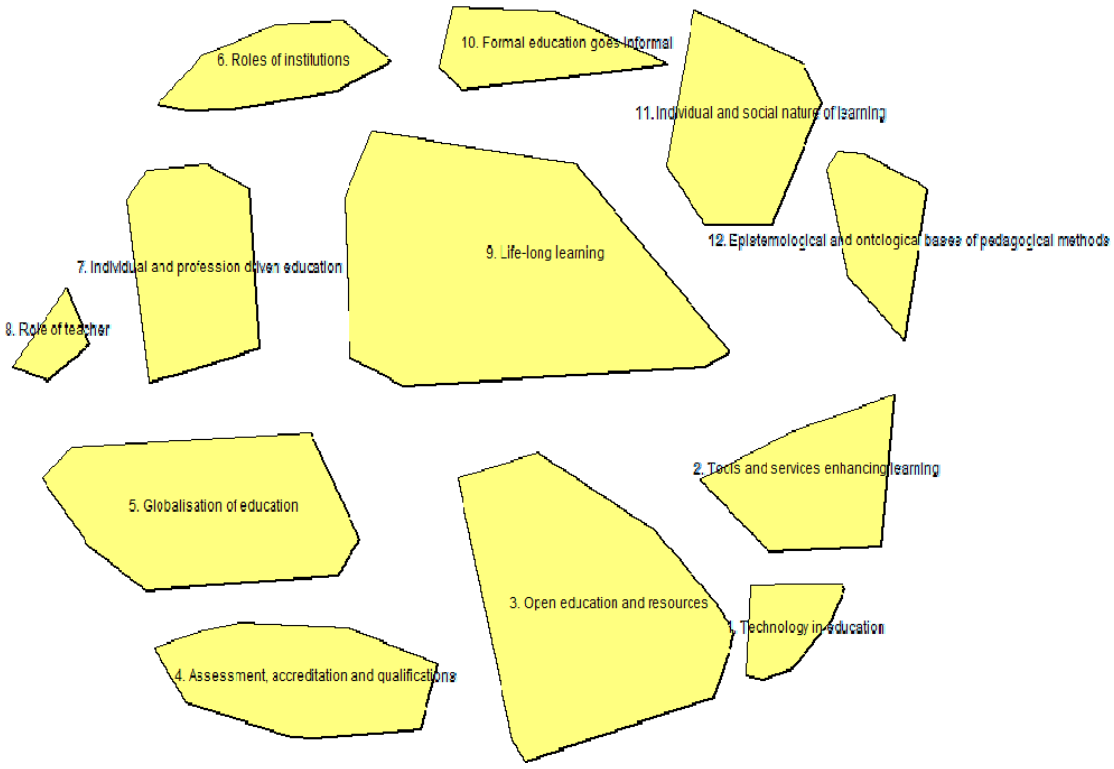

Figure 5. Cluster label map

2. RESULTS

2.1 Clusters

The following clusters emerged from the data: technology in education; tools and services enhancing learning; open education and resources; assessment, accreditation and qualifications; globalisation of education; roles of institutions; individual and profession-driven education; role of the teacher; life-long learning; formal education goes informal; individual and social nature of learning, and finally, the epistemological and ontological bases of pedagogical methods.

The title *technology in education* represented the content of the cluster well (count = 21 statements; SD = 0.08; variance = 0.01). Some representative statements were as follows:

- Virtual reality/second life will be widely used in education.
- Practice will be captured through mobile devices and integrated with cloud-based portfolios.
- Services on the internet will serve as a study environment.
- Augmented reality applications will be a major tool for learning.

The cluster *tools and services enhancing learning* was about facilitators of learning in terms of tools, materials and services (count = 14; SD = 0.09; variance = 0.01). Some representative statements were:

- Some manual skills will be developed as usual with the support of IT.
- The growing role of media for improving cognitive performance will support the learner with facts and simulation outcomes.
- Drugs that enhance learning effectiveness will be (legally?) widely available and used.
- Systems and services will be developed to allow mutual peer group learning between groups of interested learners.

The *open education and resources* cluster was about possibilities for open education, construction and access to free use of learning resources (count = 25; SD = 0.16; variance = 0.03). Representative statements were:

- Open educational resources will become widely adopted.
- There will be internet and access all around the globe, allowing learning to flow in all directions.
- Most physical (paper) libraries will have disappeared.
- Text books will be replaced by electronic multimedia publications.
- Mashups will be present at institutional and student level.
- Lecture capture will be omnipresent.
- Learning spaces groups to support informal learning will be everywhere: in super-markets, on beaches, on buses, etc.

The cluster *assessment, accreditation and qualifications* was very representative for its content (count = 19; SD = 0.24; variance = 0.06). Some of the statements included in it were:

- Different type of certifications will emerge that are not related to formal learning institutions.
- Ways will be found to align assessment with how people actually learn and to make it meaningful.

- Past learning narratives now available in portfolios will be on micro-macro view and will automatically identify missing information and skills towards specific learning goals and organisational targets.
- First steps will be taken to describe qualifications on a global level.
- We will recognise people for what they do rather than what qualifications they have.

Globalisation of education was about internationalisation of education in a broader sense; looking at education from a global rather than local perspective (count = 12; SD = 0.10; variance = 0.1). Representative statements were:

- All educational systems in Europe will be connected in a central system to identify the best students in order to support them no matter their country of origin.
- In Europe (EU) many students will learn with and from each other in international collaborations.
- We will cease to rely on experts as the source of knowledge and curriculum and move towards quality based on use and endorsement through internet systems.

The cluster *role of institutions* (count = 22; SD = 0.08; variance = 0.01) represented the content of the cluster very well. It included statements such as:

- The main roles of educational institutions will be about providing learners with guidance on how to shape their personal learning trajectories, how to choose learning formats and resources needed, and how to assess their progress and outcomes.
- A type of university that offers a syllabus of exploration will emerge, which will be like an extended sabbatical of 2 or 4 years, guided by mentors.
- Educational institutions will be reinvented as community knowledge centres serving both local communities and more widely dispersed learner groups.
- Community colleges will take care of associate and bachelor degrees.
- Inter sector and inter subject networks of institutions will combine to form networks based on purpose and interest.
- Government-funded higher education will start to privatize.

The cluster *individual and profession-driven education* was about individualisation, learner locus of control and professionalisation (count = 13; SD = 0.13; variance = 0.02). Statements included in it were as follows:

- Classmates will be matched on the basis of their knowledge, skills and preferred teaching and learning styles rather than their age.
- Learners will choose their own learning paths.
- The responsibility for learning will be with an individual, not outsourced to an external institution.
- University programmes will be focused more on specific job profiles.
- Learners will have more opportunities to find co-learners who share their learning goals and preferences (like finding people to travel with).

Some representative statements for the cluster *role of teacher* (count: 9; SD = 0.11; variance = 0.01) were as follows:

- The natural role of the teacher will be mediator of learning.
- Teachers will need to develop coaching/mentoring skills.

- Teachers will be natural learners.
- The majority of teachers will work online from home, either freelance or for an online educational organization.

The cluster *life-long learning* (count = 24, SD = 0.12; variance = 0.01) was about learning throughout life; not limited to a particular age or institution; learning at all times, everywhere. The following statements represented this cluster:

- Learning will be integrated and absorbed into in everyday activities.
- Schooling will become a less important focus for learning as learning moves into the workplace, community and home.
- It will become common for people to move between occupations with learning key to supporting such moves.
- Students will choose to learn with people from their own network.
- Professional networks will be one of the main ways of education.
- We will have to develop skills in picking up relevant learning resources from an overwhelming wealth and variety of material and build our own learning trajectories around them.

The cluster *formal education goes informal* (count = 9; SD = 0.04; variance = 0), as the title suggests, was about the shift of focus from formal to informal learning and the increasing role of informal learning. Representative statements were:

- Education will leave the class room.
- There will be a lowering of the school leaving age as it is recognised that other contexts for learning may be more effective and more motivating than school.
- Traditional disciplinary boundaries will break down with learners pursuing individual learning programmes based on multi and inter-disciplinary learning.
- Secondary education will shift towards creative authenticity and social mindedness.

The cluster *individual and social nature of learning* (count = 20; SD = 0.09; variance = 0.01) was about cognitive and social aspects of learning. Some representative examples were as follows:

- The fostering of diverse learning styles and fitting pedagogy to personal needs (to help the learner become a mature, ethical and happy person) will become more manifest than before.
- Different learning styles and adapted teaching methods for the same courses will be available for individual and social learning.
- The learner will invest more in the cerebral aspects of learning: strategic, problem-oriented, situational and creative.
- Practice will become a focus for learning.
- Learning will be considered in a proactive and active manner on demand.
- Learners will teach each other in the process of learning.

The cluster *epistemological and ontological bases of pedagogical methods* (count = 15; SD = 0.11; variance = 0.01) was about pedagogical methods and their theoretical and empirical foundations on how people learn. Examples of statements included in this cluster were:

- Social and cognitive processes and convergences will become part of the pedagogical methods.
- Gaming and learning will no longer be opposite worlds.

- Information will be manipulated [and] anchored in specific creativity techniques to facilitate synthesis and creativity.
- Guided learning in a group will be complemented with learning in and from loosely knit networks.
- Cross-curriculum (inter-disciplinary) project activities will dominate the course design.
- Constructivism will still be there, but new paradigms will have arisen.

Annex 1 provides details on the content of the clusters.

The cluster map shows that there were some more technology-oriented clusters such as 'technology in education', and 'tools and services enhancing learning'. 'Open education and resources' bridges more technology-oriented clusters and the clusters 'globalization of education' and 'assessment, accreditation and qualifications'. Technology facilitates the access of people to open education and resources. Open educational resources require adequate forms of assessment and accreditation on both national and international levels. There were a further four clusters ('role of teachers', 'role of institutions', 'individual and profession-driven education' and 'formal education goes informal') which suggest a shift of responsibility for education from institutions to the individuals concerned. Finally, there were two clusters ('individual and social nature of learning' and 'epistemological and ontological bases of pedagogical methods'), which were learning-oriented. They included issues related to cognitive and social aspects of learning as a basis for the design of effective, efficient and appealing learning environments.

One of the most important findings emerging from the data sorting was the very central place of the cluster 'life-long learning'. This cluster was a connection point for all other clusters. This implies that life-long learning needs to take into account issues related to technology, learning and teaching, and change in the role of institutions, teachers and learners.

2.2 Importance and feasibility of clusters

The analysis of the rating data indicated which ideas about the future of education the experts thought were important and which ones would be feasible in 20 years time. Figures 4 and 5 show the cluster maps on importance and feasibility.

Generally speaking, the 'learning–related' clusters scored higher on importance than the technology-oriented clusters. The cluster *individual and social aspect of learning* and *individual and profession-driven education* got the highest score on importance (5 layers). The clusters *life-long learning*, *epistemological and ontological bases of pedagogical methods* and *formal education goes informal''* had one layer less. The participants in the study perceived as the least important the clusters *technology in education* and *open education and resources.* One probable explanation for this result is that the participants perceived technology and open education just as means for learning. As the map shows, the two clusters are closely related. Technology alone is neither the problem, nor the solution for education and training. Good understanding of cognitive and social aspects of learning is a basis for designing effective learning environments and materials.

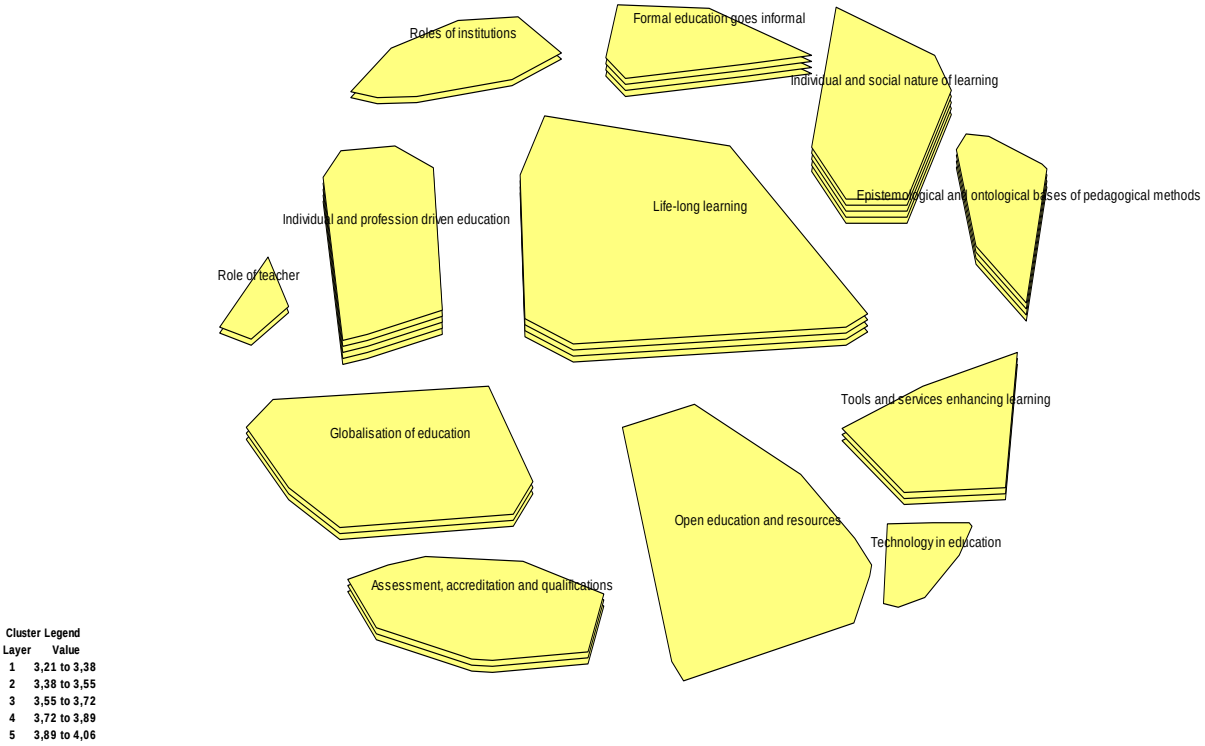

Figure 6. Cluster rating map on importance

The cluster map on feasibility (Figure 5) clearly shows that technology-oriented clusters (*technology in education, open education and resources* and *tools and services enhancing learning*) were perceived as easy to achieve. On the other hand, more learning-oriented clusters, such as informal learning, self-directed learning, personalization and professionalization of education and training were perceived as difficult to implement. It also seems that it is easier to understand learning than to use this knowledge to design learning environments (*individual and social nature of learning* had 3 layers; *epistemological and ontological bases of pedagogical methods* had two). Annex 2 presents the importance and feasibility value of each of the statements.

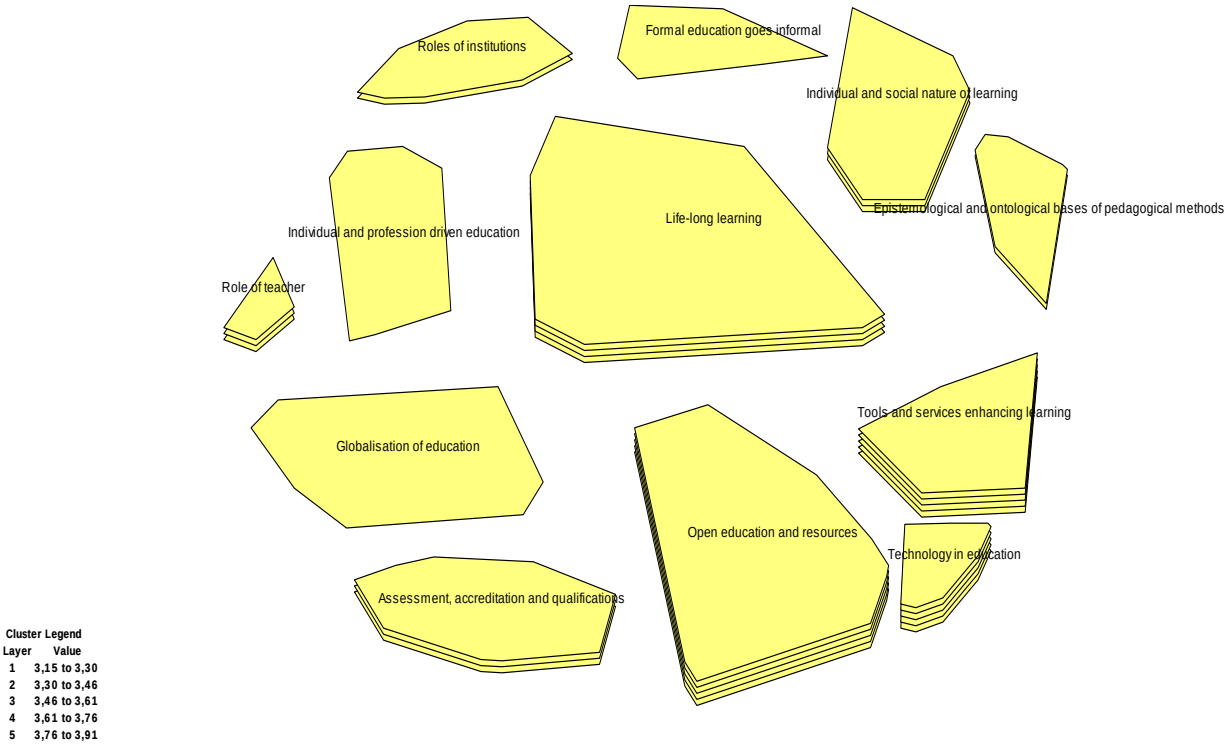

Figure 7. Cluster rating map on feasibility

2.2.1 *Between clusters comparison on importance and feasibility*

The ladder graph in Figure 8 provides a visual comparison of the clusters on importance and feasibility.

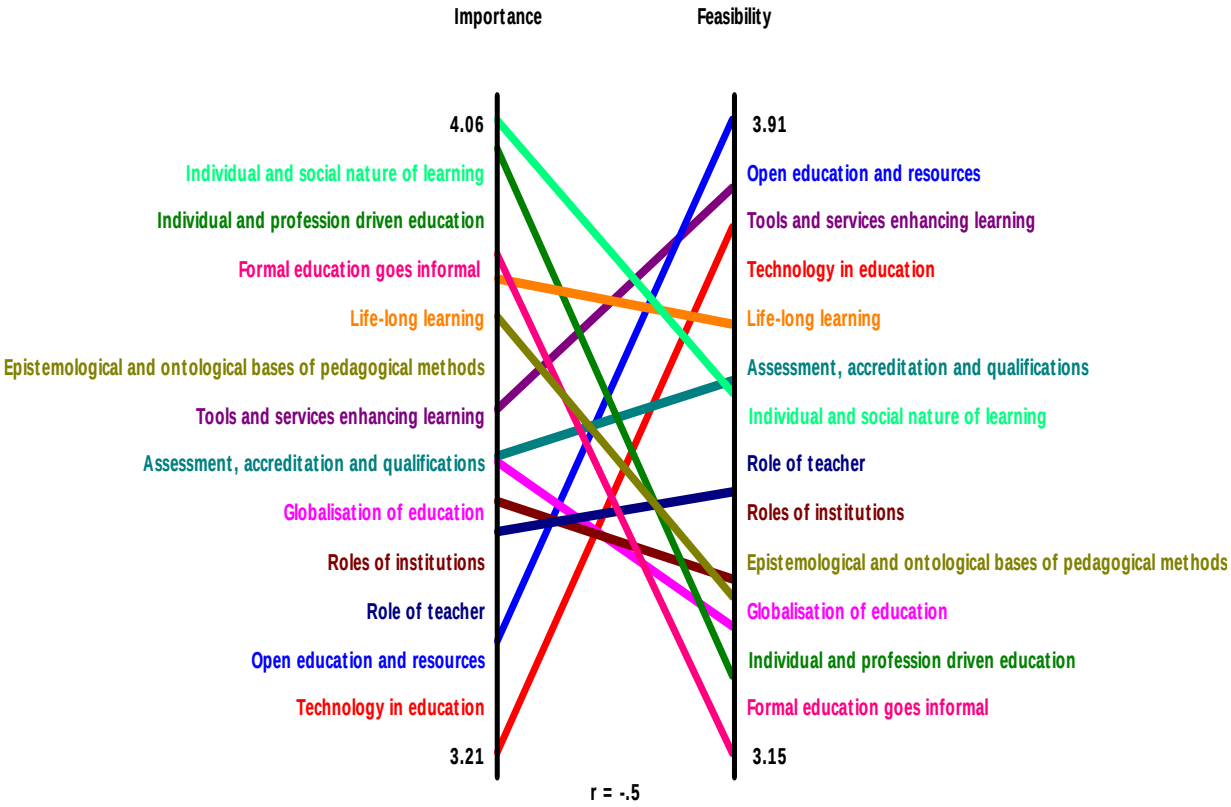

Figure 8. Comparison of clusters on importance and feasibility

There was a very weak relationship between the two values. Clusters rated as important were perceived as not feasible. The clusters 'open education and resources', 'technology in education', 'individual and social aspects of learning' and 'formal education goes informal' represented the largest margins in scores on the two scales. There were relatively small differences in the scores of clusters such as 'life-long learning', 'role of teacher', and 'assessment, accreditation' and 'qualification'.

2.2.2 *Within clusters comparison on importance and feasibility*

A specific analysis that compared the statements on importance and feasibility within a particular cluster was the "go-zone". Go-zone identifies statements that score high on both importance and feasibility, thus suggesting where we should look first when planning the implementation of changes in education and training. Go-zone is a bivariate graph that shows the average ratings for importance and feasibility on each statement within a specific cluster. For example, something that is considered to be very important could be deemed to be not very feasible. The graph is divided into quadrants based upon the mean rating values of importance and feasibility. The upper right quadrant represents issues that are above average on both variables ("go to" – very important and very feasible). Figure 9 is an example of a go-zone comparing the statements in the cluster 'life-long learning' on importance and feasibility.

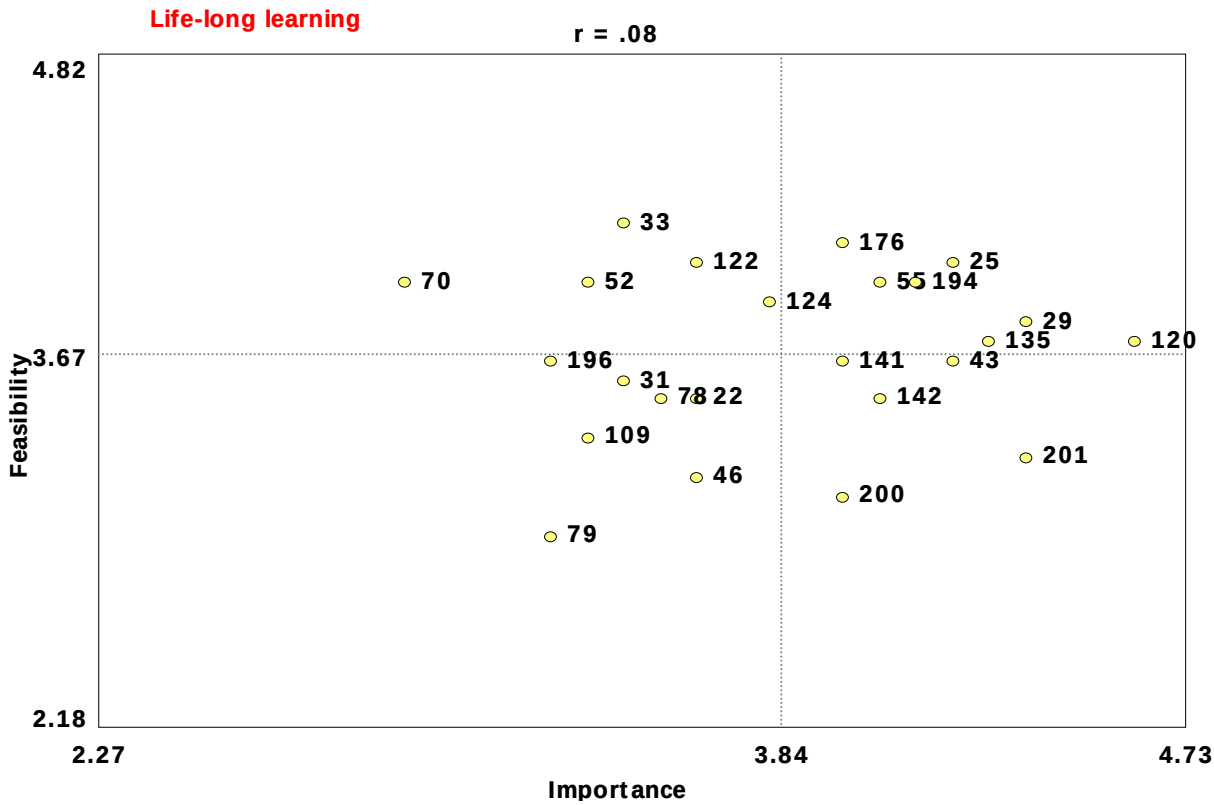

Figure 9. Life-long learning go zone

The following statements are located in the upper-right quadrant (go zone), that is to say important and feasible: “Open learning through the internet will become common” (176); “The workplace will become a major context for learning” (25); “Students will combine working and learning” (194); “University students will attend courses within their working schedule” (55); “We will have to develop skills in picking up relevant learning resources from what is abundantly there and building our own learning trajectories around them” (29); “The learning environment will change throughout one's life time, from school to workplace and home” (124); “Lifelong learning will be natural” (120); and “Education and learning will go on throughout life, from the cradle to the grave, so to speak; going from Kindergarten age to old age” (135). Annex 3 presents go-zone graphics for all clusters. The most visible orientation to the upper-right side of the graphic can be seen in the clusters *individual and social nature of learning* and *individual and profession-driven education*. *Globalisation of education* and *role of teacher* each have only one statement in the upper-right quadrant. *Individual and social nature of learning* has the highest positive correlation between importance and feasibility (r = .66), followed by *individual and profession-driven education* (r = .48). *Globalisation of education* has the highest negative correlation between the two values (r = -.41). The lowest correlation between importance and feasibility can be found in the following clusters: *assessment, accreditation and qualification* (r = .07), *life-long learning* (r = .08), and *role of teacher* (r = -.09). Annex 4 is a list of statements for all clusters that are located in the upper-right quadrant. They represent about 25% of all the ideas generated.

3. CONCLUSIONS

Employing Group Concept Mapping within the Future of Learning project proved to be an effective and efficient approach to generating a first, tentative, landscape of future learning strategies and pathways, outlining major changes to education and training over the next 10-20 years, indicating the relationship of different trends to one another and revealing some initial insights on the importance and feasibility of some of the more salient changes envisaged for the future. The method was not only appealing to participants, but also served as a valuable tool for data collection, aggregation and analysis.

The results from the GCM study lay the empirical grounds for the Future of Learning project, to be further elaborated later. Given the nature of the data collection and analysis, the emerging landscape can only serve as a starting point for further discussion and elaboration of visions for the future of learning. Its main value lies in inspiring this debate and highlighting some themes and issues which could be of particular relevance and importance for the future of learning and should therefore be considered more carefully when envisaging and addressing future learning needs and strategies.

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ANNEX 1: FULL CLUSTER DESCRIPTION

Cluster 1: Technology in education

No.	Statement	Bridging value
166	Augmented reality applications will be a major tool for learning,	.00
130	Mobile internet enabled devices will become the major tool for learning.	.00
83	Phone, pc, e-reader will have merged in one application.	.00
34	Technology will bridge time and space in learning.	.03
150	Mobile devices will be used in education to create content.	.04
86	Electronic learning environments will have greatly increased possibilities.	.04
106	The role of ICT will change throughout one's life time, from a supporting role to an overriding, unavoidable presence (wearable computers, in one's ordinary functioning integrated).	.07
132	Electronic learning environments will become more and more integrated with groupware systems.	.07
91	Virtual reality/Second life will be widely used in education.	.07
1	Practice will be captured through mobile devices and integrated with cloud based portfolios.	.07
138	The intense merger of new technologies with the better understanding of learning will produce educational application that never allows people to forget what they have previously experienced or learned.	.09
203	Services on the internet will serve as a study environment.	.10
198	Desktop conferencing will become used to keep in touch with peer students from abroad.	.10
167	Information will be available in many different forms, not only multimedia but connected media via mash-ups.	.12
39	Life communication in education will never be fully replaced by technologies.	.17
170	Education will leverage the technology advancement	.18
73	Wearable, computing devices.	.18
90	There will be no such thing as a 'digital learning environment.	.21
75	Mobile learning will be natural.	.23
35	Multi User Virtual Environments will render physical attendance in school and university unnecessary.	.24
157	Internet will be main media for delivery of education.	.27

Count:	21	Std. Dev.:	0.08	Minimum:	0.00	Average:	.11
		Variance:	0.01	Maximum:	0.27	Median:	0.09

Cluster 2: Tools and services enhancing learning

No.	Statement	Bridging value
126	Technologies will change emphases on some of the subjects.	.27
178	Technology-enhanced learning should be basic requirement skills for every learner.	.33
154	Some manual skills will be developed as usual with support of IT.	.33
27	The growing role of media for improving cognitive performance will support the learner with facts and simulation outcomes.	.34
185	Precious time of f2f contact will not be missed for activities that could be done in technology-mediated [environment].	.35
168	Learning should be social and supported by social web technology.	.38
199	Drugs that enhance learning effectiveness will be (legally?) widely available and used as well.	.44
128	Context specific learning materials and tasks will lead to more localised learning.	.47
182	Courses will be available in different forms (text. online. mobile. teacher-based instructions).	.51
121	Learning from one's own mistakes takes an entirely new dimension thanks to user- generated content. social media and attention metadata.	.51
183	Systems and services will be developed to allow mutual peer group learning between groups of interested learners.	.52
101	Technology and pedagogy will align such that students can participate in learning environments that will allow them to have high quality learning experiences.	.52
107	Online communities will be widely used in education.	.53
62	Students and faculty will choose their own application providers.	.55

Count:	14	Std. Dev.:	0.09	Minimum:	0.27	Average:	.43
		Variance:	0.01	Maximum:	0.55	Median:	0.46

Cluster 3: Open education and resources

No.	Statement	Bridging value
153	Although time constraints will still apply. the constraints of physical space will go, allowing communication wherever one wants at the time agreed upon.	.16
50	Consumer/Communication electronics will continue to drive technology	.16
59	Replays of previous learning experiences with user-generated videos and posts on the social software sites bring up evidence and revoke the re-learning.	.17
202	There will be internet and access to it everywhere and all around the globe, allowing learning to flow in all directions.	.19
100	Mashups will be present at institutional and students level.	.20
152	Digital identities (and portfolios) will replace traditional CVs.	.22
26	Portfolio views will be mashed-up.	.24
74	Lecture capture will be omnipresent.	.26
8	Internships will be better supervised by using social networking tools.	.27
143	Lecture capture will contain student contributions.	.31
64	Most physical (paper) libraries will have disappeared.	.31
17	Blogs and other internet based multi media will be recognised as legitimate publications for researchers.	.34
177	Students will obtain online profiles (and kudos) in their institutions.	.34
19	Online social networking will become more important.	.34
144	Learning on the move (anytime and anywhere).	.34
40	Text books will be replaced by electronic multimedia publications.	.37
81	Physical (paper) libraries have the task to preserve rare collections.	.38
187	There will be digital library services.	.45
155	Online courses will be available in many different languages with access from all over the world.	.47
85	Portfolios will be generated by aggregating content from other sources.	.50
63	Open Educational Resources will become widely adopted.	.51
96	Learning spaces-groups to support informal learning will be everywhere, the super-markets, on beaches, on the buses etc.	.51
117	Knowledge-based society would mean access and sharing of knowledge with technology support.	.54
137	Most IT services of Higher Education institutions will come from commercial providers.	.66
134	Knowledge will be build-up non-systematically.	.81

Count:	25	Std. Dev.:	0.16	Minimum:	0.16	Average:	.36
		Variance:	0.03	Maximum:	0.81	Median:	0.34

Cluster 4: Assessment, accreditation and qualifications

No.	Statement	Bridging value
147	There will be specialized (commercial) testing/assessment organizations that take care of grading.	.06
48	The degrees will also include information about the students' soft skills.	.08
47	Qualifications will be checked and maintained on a European level.	.15
9	High stakes testing will disappear.	.15
99	Continued education, assessment of certificates of acquired knowledge/skills/competences by standard educational framework.	.22
136	First steps will be taken to describe qualifications on a global level.	.24
2	There will be ways to get accredited for learning outside of formal institutions.	.27
197	Different type of certifications will emerge that are not related to formal learning institutions.	.27
67	Student test performance/progress is logged over years.	.29
87	Most testing will be done online.	.33
84	There will be vast item banks for testing.	.38
6	We will recognise people for what they do rather than what qualifications they have.	.46
20	Will find ways to align assessment with how people actually learn and to make it meaningful.	.56
72	Most (educational) content will be digital.	.63
118	Past learning narrative now available in portfolios will be on micro-macro view and will automatically identify missing information and skills towards specific learning goals and organisational targets.	.70
145	Students will create content in all courses.	.71
113	Free online content is used as a marketing tool.	.72
88	There will be an abundance of easily available learning resources, but a challenge [is] to find guidance around them.	.73
104	Virtual mobility will break down barriers between national education systems.	.83

Count:	19	Std. Dev.:	0.24	Minimum:	0.06	Average:	.41
		Variance:	0.06	Maximum:	0.83	Median:	0.33

Cluster 5: Globalisation of education

No.	Statement	Bridging value
93	All educational systems in Europe will be connected in a central system to identify the best students in order to support them no matter the country of origin.	.61
57	High course fees will deter many working class students from attending higher education.	.66
140	Appropriate, accessible, affordable education.	.70
68	Educational content will be produced by commercial organizations.	.72
149	Students will pay more for their learning programmes.	.73
37	We will cease to rely on experts as the source of knowledge and curriculum and move towards quality based on use and endorsement through internet systems.	.77
111	Knowledge will be bringing in education from interested stakeholders.	.81
129	The right people (wherever they are) gain strength and are the key to success.	.83
102	Getting free education and educational contents should become basic human rights.	.83
163	Students will learn increasingly globally.	.84
159	In Europe (EU) many students will learn with and from each other in international collaborations.	.87

Count:	12	Std. Dev.:	0.10	Minimum:	0.53	Average:	.74
		Variance:	0.01	Maximum:	0.87	Median:	0.75

Cluster 6: Roles of institutions

No.	Statement	Bridging value
16	The main roles of educational institutions will be about providing learners with guidance on how to shape their personal learning trajectories, how to choose learning formats and resources needed, and how to assess their progress and outcomes.	.24
158	Higher education will return to its traditional core purpose of research.	.24
169	Educational institutions will be driven by interests of society.	.24
190	Schools will loose their function.	.25
3	Research universities will provide expensive on campus education.	.25
42	Online teaching universities will provide cheap online education.	.29
13	The Sabbatical-like University will emerge, institutions that offer a syllabus of exploration, like in a sabbatical year but in 2 or 4 years, guided my mentors.	.30
191	Private higher education organizations will have an increased market.	.30
4	The number of on campus Higher Education institutions will have reduced to a few that able to compete internationally.	.30
65	Educational institutions will be reinvented as community knowledge centres serving both geographical communities and wider dispersed communities.	.33
189	The role of institutions will change from being the single provider of learning opportunities that delivers a variety of services to being one of several institutions that delivers a specialised service only.	.33
186	Formal learning will become more episodic with people entering and leaving education at various points in their career path.	.35
131	Bricks and mortar educational structures will be unnecessary for most students as they will have access to education where ever they are.	.36
82	Community colleges take care of the associate and bachelor degrees.	.38
97	Inter sector and inter subject networks of institutions will combine to form networks based on purpose and interest.	.40
108	The financial crisis will lead to increasing privatization of university.	.42
110	Educational institutions or certifications may disappear and communities or networking will replace these.	.43
180	Higher Education institutions will merge cross borders in Europe.	.44
112	The locus of learning will shift from physical institutions in the beginning (schools certainly at the age of Kindergarten or preschool) to non-institution based at best at virtual institutions but probably mostly in self-organising network-like construction.	.44
14	Higher Education institutions will expand cross borders in Europe.	.45
171	There will be specialized (commercial) organizations for brush-up courses.	.45
156	Government funded higher education will start to privatize.	.47

Count:	22	Std. Dev.:	0.08	Minimum:	0.24	Average:	.35
		Variance:	0.01	Maximum:	0.47	Median:	0.34

Cluster 7: Individual and profession driven education and training

No.	Statement	Bridging value
175	Education will continue to support the need for a highly qualified work force.	.55
28	Classmates will be matched based on their knowledge, skills and preferred teaching and learning styles rather than their age.	.55
0	The global university will be a fact, people distributed all around, no boundaries, location loses power.	.60
116	Networked education settings rather than centralized educational institutes.	.61
49	Learner will choose alone its learning path.	.64
114	Classes will be not limited in terms of age, distance, etc.	.64
148	The responsibility for learning will be with an individual, not outsourced to an external institution.	.69
193	Learners will be expected to take control of their own learning.	.71
133	University programmes will be focused more on specific job profiles.	.74
115	Learners will have more opportunities to find co-learners who share their learning goals and preferences (similarly to finding people to travel together).	.79
192	Schools will be places where students will go to learn techniques of handling information.	.81
10	The ability of an individual to make choices about where and how to learn will be supported by laws and financial mechanisms.	.90
80	Teachers target more the metacognitive, emotional and the moral aspects.	1.00

Count:	13	Std. Dev.:	0.13	Minimum:	0.55	Average:	.71
		Variance:	0.02	Maximum:	1.00	Median:	0.69

Cluster 8: Role of teachers/trainers

No.	Statement	Bridging value
165	Natural role of the teacher will be mediator of learning.	.34
160	Teachers will need to develop coaching/mentoring skills	.34
51	Teacher will be natural learner.	.39
66	The best teachers/researchers work on campus.	.47
71	On campus teachers will use tutors to assist them in teaching.	.49
119	Privacy of staff will decrease.	.54
181	The majority of teachers work online from home either freelance or for an online educational organization.	.54
77	Teachers will be orchestrators of learning activities.	.61
38	Privacy of students will decrease.	.65

Count:	9	Std. Dev.:	0.11	Minimum:	0.34	Average:	.49
		Variance:	0.01	Maximum:	0.65	Median:	0.49

Cluster 9: Life-long learning

No.	Statement	Bridging value
33	The boundaries between learning-work-private lives will disappear.	.29
78	Learning will be integrated and disappeared in everyday activities.	.32
25	The workplace will become a major context for learning.	.34
142	The learning component of education will become more and more endemic to life (work. play. and socialize) rather than the certificate-oriented formal learning according to modal curricula.	.34
135	Education and learning will last throughout one's whole life, from cradle to grave so to speak, going from Kindergarten age to being a senior citizen.	.35
79	Vocational education and training become the major organisational form of learning.	.35
194	Students will combine working and learning.	.37
200	Schooling will become a less important focus for learning as learning moves into the workplace, community and home.	.38
120	Lifelong learning will be natural.	.39
124	The learning environment will change throughout one's life time, from school to workplace and home.	.40
55	University students will attend university courses within their working schedule.	.40
43	It will become common for people to move between occupations with learning key to supporting such moves.	.40
141	The learning environment will change throughout one's life time, from knowledge transfer and socialization to knowledge independent knowledge acquisition and voluntary social interaction.	.42
22	Occupational profiles will become broader incorporating elements of what are now seen as individual occupations.	.43
201	Education should cater the functional needs of every citizen irrespective of age.	.45
46	There will be a shift from career focus to personal focus.	.47
122	Students will choose to learn with people from their own network.	.51
70	Students will keep in touch with their universities after they have graduated.	.52
196	A study environment will consist of services that are not specific to education.	.56
109	Professional networks will be one of the main ways of education.	.58
29	We will have to develop skills in picking up relevant learning resources from what is abundantly there and building our own learning trajectories around them.	.63
31	Management of digital identities will become a crucial competence.	.66
52	Higher Education institutions will cooperate in procuring services from commercial providers.	.67
176	Open learning through the internet will become common.	.70

Count:	24	Std. Dev.:	0.12	Minimum:	0.29	Average:	.45
		Variance:	0.01	Maximum:	0.70	Median:	0.41

Cluster 10: Formal education and training goes informal

No.	Statement	Bridging value
123	Education will leave the class room.	.47
24	Exploratory and creative learning initiatives or institutions will emerge to help build the leadership of the future.	.50
5	Secondary education will shift towards the creative, authentic and social mindedness.	.51
12	There will be a lowering of the school leaving age as it is recognised that other contexts for learning may be more effective and more motivating than school.	.52
45	Participants in education will be really motivated to participate in it.	.54
151	Class size will depend on the selected course/method.	.56
36	Traditional disciplinary boundaries will break down with learners pursuing individual learning programmes based on multi and inter disciplinary learning.	.57
56	Online teaching universities will provide centres for skills development (skills labs).	.58
15	Institutions will integrate the power of the self in their core programs. career stepping behind.	.58

Count:	9	Std. Dev.:	0.04	Minimum:	0.47	Average:	.54
		Variance:	0.00	Maximum:	0.58	Median:	0.54

Cluster 11: Individual and social nature of learning

No.	Statement	Bridging value
11	The fostering of diverse learning styles and its fit to pedagogy (becoming a mature, ethical and happy person) will become more manifest than before.	.27
95	Learning will be much individualized.	.27
41	Students' learning will be based on curiosity.	.29
92	The pedagogy of learning will change throughout one's life time, from fit for children to fit for adults.	.32
127	Education will be segmented into bites of learning, so individuals can make their personal paths to gaining the knowledge they require.	.32
23	Different learning styles and adapted teaching methods of the same courses will be available for individual and social learning.	.33
173	Learning will be more integrated with daily life or work.	.36
179	The learner will invest more in the cerebral aspects of learning: Strategic, problem-oriented, situational, and creativeness.	.37
98	Education will be more personalized.	.38
164	Practice will become a focus for learning	.39
44	Learning at all levels will be closer connected to practice.	.39
21	Education will be interests-driven.	.43
76	Informal education will be main type of education.	.44
7	Learning will be considered in a proactive and active manner on demand.	.44
139	Study paths will become more flexible.	.45
184	Choices and flexibility around learning will be the norm, also in primary/secondary education.	.45
174	Personalized educational contents which meet learners job requirements.	.47
89	Personal Learning Environments will replace institutional Virtual Learning environments.	.47
18	Learner will teach other participants in process of learning.	.53
61	Learning programmes will be more flexible then they are now.	.64

Count:	20	Std. Dev.:	0.09	Minimum:	0.27	Average:	.40
		Variance:	0.01	Maximum:	0.64	Median:	0.39

Cluster 12: Epistemological and ontological bases of pedagogical methods

No.	Statement	Bridging value
188	Experiential and immersive learning will be the norm.	.29
172	Social and cognitive processes and convergences will become part of the pedagogical methods.	.32
125	Constructivism will still be there, but new paradigms will have arisen.	.34
162	Primary education will accept a larger pedagogical role: Learning to Learn rather than learning the complete subject domains like nowadays.	.34
161	Learning methods will gradually change over one's life time: from being instructor led to learner led.	.36
105	Learning will be accepted more and more as a social and personality-bounded process.	.36
146	Collaborative-learning will be widely spread.	.41
32	Our knowledge of the biological determinants of learning will vastly increase (relation to diurnal rhythms, to brain chemistry and brain topography of learning).	.41
58	Art will take a much stronger role in all educational institutions and initiatives.	.47
103	Gaming and learning are no longer opposite worlds.	.50
54	Collaboration in learning -and not only- will be the only way forward.	.51
94	Information will be manipulated [and] anchored in specific creativity techniques to facilitate synthesis and creativity.	.57
53	Guided learning in a group will be complemented with learning in and from loosely knit networks.	.57
195	Cross-curriculum (inter-disciplinary) project activities will dominate the course design.	.59
60	Learning content should be joyful. game-based and functional	.60

Count:	15	Std. Dev.:	0.11	Minimum:	0.29	Average:	.44
		Variance:	0.01	Maximum:	0.60	Median:	0.41

ANNEX 2: LIST OF STATEMENTS

List of all Statements with their Ratings on Importance and Feasibility

No.	Statements	Criteria	
		Impor-tance	Feas-ibility
1	Practice will be captured through mobile devices and integrated with cloud based portfolios.	2.73	4.00
2	There will be ways to get accredited for learning outside of formal institutions.	3.82	3.91
3	Research universities will provide expensive on campus education.	2.27	3.55
4	The number of on campus Higher Education institutions will have reduced to a few that able to compete internationally.	2.91	3.18
5	Secondary education will shift towards the creative, authentic and social mindedness.	3.73	2.73
6	We will recognise people for what they do rather than what qualifications they have.	4.27	3.36
7	Learning will be considered in a proactive and active manner on demand.	4.18	3.45
8	Internships will be better supervised by using social networking tools.	2.91	3.82
9	High stakes testing will disappear.	2.91	2.18
10	The ability of an individual to make choices about where and how to learn will be supported by laws and financial mechanisms.	4.09	3.18
11	The fostering of diverse learning styles and its fit to pedagogy (becoming a mature, ethical and happy person) will become more manifest than before.	3.64	3.45
12	There will be a lowering of the school leaving age as it is recognised that other contexts for learning may be more effective and more motivating than school.	3.27	2.55
13	The Sabbatical-like University will emerge, institutions that offer a syllabus of exploration, like in a sabbatical year but in 2 or 4 years, guided my mentors.	3.55	2.82
14	Higher Education institutions will expand cross borders in Europe.	4.18	4.18
15	Institutions will integrate the power of the self in their core programs, career stepping behind.	3.82	2.55
16	The main roles of educational institutions will be about providing learners with guidance on how to shape their personal learning trajectories, how to choose learning formats and resources needed, and how to assess their progress and outcomes.	4.18	3.36
17	Blogs and other internet based multi media will be recognised as legitimate publications for researchers.	2.82	3.18
18	Learner will teach other participants in process of learning.	3.91	3.82
19	Online social networking will become more important.	3.82	4.45
20	Will find ways to align assessment with how people actually learn and to make it meaningful.	4.18	3.00
21	Education will be interests-driven.	3.82	3.45
22	Occupational profiles will become broader incorporating elements of what are now seen as individual occupations.	3.64	3.45
23	Different learning styles and adapted teaching methods of the same courses will be available for individual and social learning.	3.64	3.45
24	Exploratory and creative learning initiatives or institutions will emerge to help build the leadership of the future.	3.91	2.91
25	The workplace will become a major context for learning.	4.27	4.09
26	Portfolio views will be mashed-up.	3.18	3.91
27	The growing role of media for improving cognitive performance will support the learner with facts and simulation outcomes.	3.82	4.09
28	Classmates will be matched based on their knowledge, skills and preferred teaching and learning styles rather than their age.	4.27	3.09
29	We will have to develop skills in picking up relevant learning resources from what is abundantly there and building our own learning trajectories around them.	4.45	3.82

No.	Statements	Criteria	
		Impor-tance	Feas-ibility
30	The global university will be a fact, people distributed all around, no boundaries, location loses power	4.00	3.45
31	Management of digital identities will become a crucial competence.	3.45	3.55
32	Our knowledge of the biological determinants of learning will vastly increase (relation to diurnal rhythms, to brain chemistry and brain topography of learning).	3.27	3.55
33	The boundary between learning-work-private life will disappear.	3.45	4.27
34	Technology will bridge time and space in learning.	4.00	4.45
35	Multi User Virtual Environments will render physical attendance in school and university unnecessary.	2.73	3.00
36	Traditional disciplinary boundaries will break down with learners pursuing individual learning programmes based on multi and inter disciplinary learning.	4.55	3.55
37	We will cease to rely on experts as the source of knowledge and curriculum and move towards quality based on use and endorsement through internet systems.	3.36	3.36
38	Privacy of students will decrease.	2.55	3.55
39	Life communication in education will never be fully replaced by technologies.	3.64	3.64
40	Text books will be replaced by electronic multi media publications.	3.27	4.27
41	Students' learning will be based on curiosity.	4.09	3.00
42	Online teaching universities will provide cheap on line education.	3.91	3.36
43	It will become common for people to move between occupations with learning key to supporting such moves.	4.27	3.64
44	Learning at all levels will be closer connected to practice.	4.09	3.73
45	Participants in education will be really motivated to participate in it.	4.27	2.91
46	There will be a shift from career focus to personal focus.	3.64	3.09
47	Qualifications will be checked and maintained on a European level.	3.82	4.09
48	The degrees will also include information about the students' soft skills.	4.18	3.00
49	Learner will choose alone its learning path.	3.73	2.73
50	Consumer/Communication electronics will continue to drive technology	2.36	4.27
51	Teacher will be natural learner.	4.18	2.91
52	Higher Education institutions will cooperate in procuring services from commercial providers.	3.36	4.00
53	Guided learning in a group will be complemented with learning in and from loosely knit networks.	4.27	4.55
54	Collaboration in learning -and not only- will be the only way forward.	3.36	2.91
55	University students will attend university courses within their working schedule.	4.09	4.00
56	Online teaching universities will provide centres for skills development (skills labs).	4.36	3.73
57	High course fees will deter many working class students from attending higher education.	2.91	3.45
58	Art will take a much stronger role in all educational institutions and initiatives.	2.73	2.36
59	Replays of previous learning experience, with user- generated videos and posts on the social software sites bring up evidence and revokes the re-learning.	3.64	3.82
60	Learning content should be joyful, game-based and functional	3.91	3.09
61	Learning programmes will be more flexible then they are now.	4.73	4.27
62	Students and faculty will choose their own application providers.	3.09	4.00
63	Open Educational Resources will become widely adopted.	4.36	4.09
64	Most physical (paper) libraries will have disappeared.	2.64	3.45
65	Educational institutions will be reinvented as community knowledge centres serving both geographical communities and wider dispersed communities.	4.36	3.45

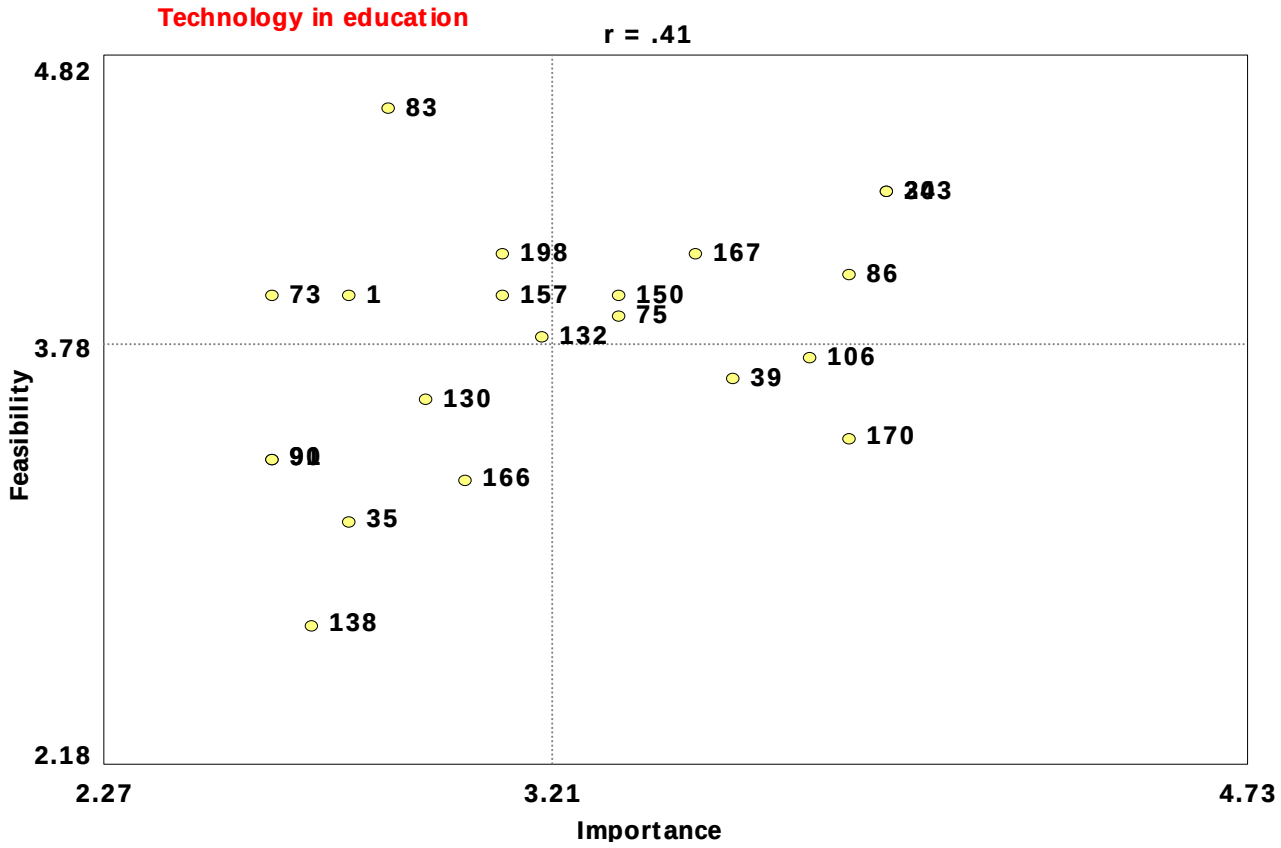
No.	Statements	Criteria	
		Impor-tance	Feas-ibility
66	The best teachers/researchers work on campus.	3.00	3.18
67	Student test performance/progress is logged over years.	3.18	4.18
68	Educational content will be produced by commercial organizations.	2.73	3.64
69	Lecturers will work increasingly globally.	3.45	3.73
70	Students will keep in touch with their universities after they have graduated.	2.91	4.00
71	On campus teachers will use tutors to assist them in teaching.	3.09	4.27
72	Most (educational) content will be digital.	3.73	4.36
73	Wearable computing devices.	2.55	4.00
74	Lecture capture will be omnipresent.	2.64	4.00
75	Mobile learning will be natural.	3.36	3.91
76	Informal education will be main type of education.	3.00	2.36
77	Teachers will be orchestrators of learning activities.	3.82	3.27
78	Learning will be integrated and disappeared in everyday activities.	3.55	3.45
79	Vocational education and training become the major organisational form of learning.	3.27	2.82
80	Teachers target more the metacognitive, emotional and the moral aspects.	3.64	2.55
81	Physical (paper) libraries have the task to preserve rare collections.	3.36	4.27
82	Community colleges take care of the associate and bachelor degrees.	3.27	3.36
83	Phone, pc, e-reader will have merged in one application.	2.82	4.82
84	There will be vast item banks for testing.	3.18	4.27
85	Portfolios will be generated by aggregating content from other sources.	3.55	3.91
86	Electronic learning environments will have greatly increased possibilities.	3.91	4.09
87	Most testing will be done online.	3.27	4.18
88	There will be an abundance of easily available learning resources, but a challenge [is] to find guidance around them.	4.18	4.36
89	Personal Learning Environments will replace institutional Virtual Learning environments.	3.73	3.91
90	There will be no such thing as a ‘digital learning environment.	2.55	3.27
91	Virtual reality/Second life will be widely used in education.	2.55	3.27
92	The pedagogy of learning will change throughout one's life time, from fit for children to fit for adults	4.36	3.82
93	All educational systems in Europe will be connected in a central system to identify the best students in order to support them no matter the country of origin.	3.45	2.45
94	Information will be manipulated [and] anchored in specific creativity techniques to facilitate synthesis and creativity.	3.91	2.82
95	Learning will be much individualized.	4.09	3.82
96	Learning spaces-groups to support informal learning will be everywhere, the super-markets, on beaches, on the buses etc.	3.45	3.45
97	Inter sector and inter subject networks of institutions will combine to form networks based on purpose and interest.	4.09	3.64
98	Education will be more personalized.	4.64	3.73
99	Continued education, assessment of certificates of acquired knowledge/skills/competences by standard educational framework.	3.82	3.73
100	Mashups will be present at institutional and students level.	3.00	3.91
101	Technology and pedagogy will align such that students can participate in learning environments that will allow them to have high quality learning experiences.	4.36	3.36
102	Getting free education and educational contents should become basic human rights.	4.64	2.45
103	Gaming and learning are no longer opposite worlds.	3.09	3.27

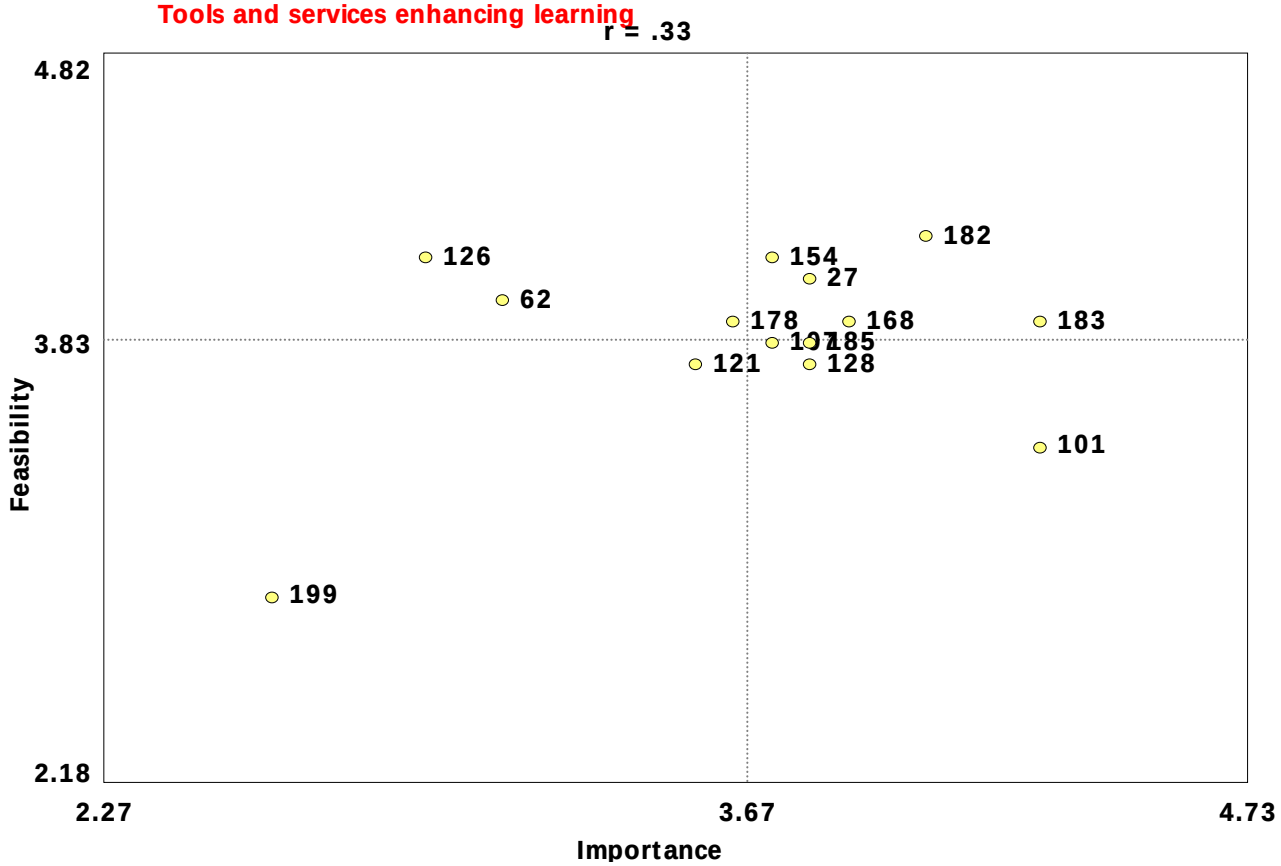
No.	Statements	Criteria	
		Impor-tance	Feas-ibility
104	Virtual mobility will break down barriers between national education systems.	3.91	3.36
105	Learning will be accepted more and more as a social and personality-bounded process.	3.82	2.82
106	The role of ICT will change throughout one's life time, from a supporting role to an overriding, unavoidable presence (wearable computers, in one's ordinary functioning integrated).	3.82	3.73
107	Online communities will be widely used in education.	3.73	3.82
108	The financial crisis will lead to increasing privatisation of university.	3.36	3.82
109	Professional networks will be one of the main ways of education.	3.36	3.27
110	Educational institutions or certifications may disappear, and communities or networking will replace these.	2.91	2.36
111	Knowledge will be bringing in education from interested stakeholders.	3.36	3.09
112	The locus of learning will shift, from physical institutions in the beginning (schools, certainly at the age of Kindergarten or preschool) to non-institution based, at best at virtual institutions but probably mostly in self-organising network-like constructions.	3.82	3.27
113	Free online content is used as a marketing tool.	2.27	3.64
114	Classes will be not limited in terms of age, distance, etc.	3.91	2.91
115	Learners will have more opportunities to find co-learners who share their learning goals and preferences (similarly to finding people to travel together).	4.45	3.64
116	Networked education settings rather than centralized educational institutes.	4.00	3.64
117	Knowledge-based society would mean access and sharing of knowledge with technology support.	3.82	3.64
118	Past learning narrative now available in portfolios will be on micro-macro view and will automatically identify missing information and skills towards specific learning goals and organisational targets.	3.91	3.27
119	Privacy of staff will decrease.	2.73	3.09
120	Lifelong learning will be natural.	4.73	3.73
121	Learning from one's own mistakes takes an entirely new dimension thanks to user-generated content, social media and attention metadata.	3.55	3.73
122	Students will choose to learn with people from their own network.	3.64	4.09
123	Education will leave the class room.	3.45	3.82
124	The learning environment will change throughout one's life time, from school to workplace and home	3.82	3.91
125	Constructivism will still be there, but new paradigms will have arisen.	4.09	4.55
126	Technologies will change emphases on some of the subjects.	2.91	4.18
127	Education will be segmented into bites of learning, so individuals can make their personal paths to gaining the knowledge they require.	3.45	3.45
128	Context specific learning materials and tasks will lead to more localised learning.	3.82	3.73
129	The right people (wherever they are) gain strength and is the key to success.	4.00	2.73
130	Mobile internet enabled devices will become the major tool for learning.	2.91	3.55
131	Bricks and mortar educational structures will be unnecessary for most students as they will have access to education where ever they are.	3.36	2.91
132	Electronic learning environments will become more and more integrated with groupware systems.	3.18	3.82
133	University programmes will be focused more on specific job profiles.	3.45	3.18
134	Knowledge will be build-up non-systematically.	3.09	3.45
135	Education and learning will last throughout one's whole life, from cradle to grave so to speak, going from Kindergarten age to being a senior citizen.	4.36	3.73
136	First steps will be taken to describe qualifications on a global level.	3.64	3.55

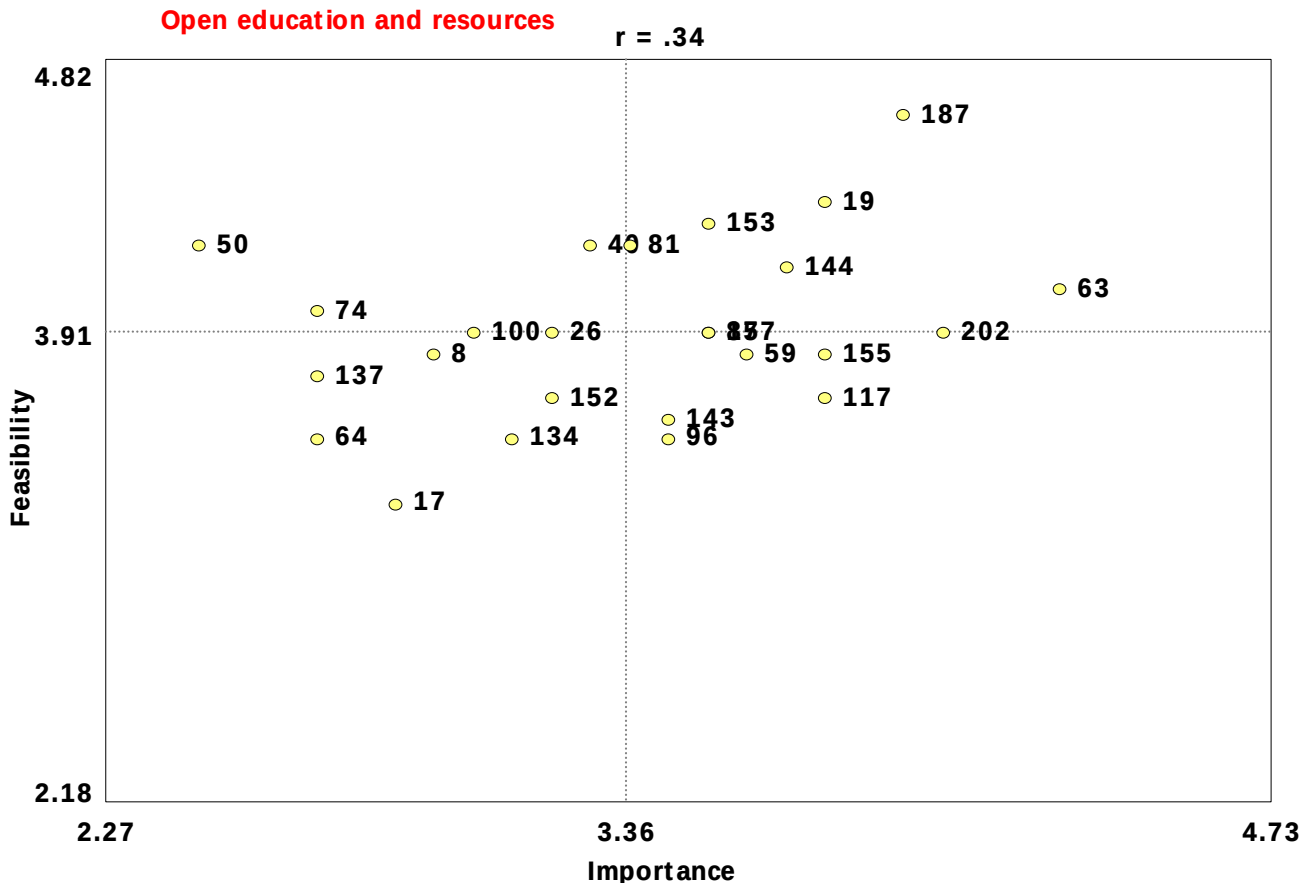
No.	Statements	Criteria	
		Impor-tance	Feas-ibility
137	Most IT services of Higher Education institutions will come from commercial providers.	2.64	3.73
138	The intense merger of new Technologies with the better understanding of learning will produce educational application that never allows people to forget what they have previously experienced or learned.	2.64	2.55
139	Study paths will become more flexible.	4.55	3.91
140	Appropriate, accessible affordable Education.	4.64	3.09
141	The learning environment will change throughout one's life time, from knowledge transfer and socialization to knowledge independent knowledge acquisition and voluntary social interaction	4.00	3.64
142	The learning component of education will become more and more endemic to life (work, play, and socialize) rather than the certificate-oriented formal learning according to modal curricula.	4.09	3.45
143	Lecture capture will contain student contributions.	3.45	3.55
144	Learning on the move (anytime and anywhere).	3.73	4.18
145	Students will create content in all courses.	3.00	3.09
146	Collaborative-learning will be widely spread.	4.09	3.45
147	There will be specialized (commercial) testing/assessment organizations that take care of grading	3.00	3.27
148	The responsibility for learning will be with an individual, not outsourced to an external institution.	4.27	3.27
149	Students will pay more for their learning programmes.	2.64	3.82
150	Mobile devices will be used in education to create content.	3.36	4.00
151	Class size will depend on the selected course/method.	3.55	3.64
152	Digital identities (and portfolios) will replace traditional CVs.	3.18	3.64
153	Although time constraints will still apply, the constraints of physical space will go, allowing communication wherever one wants at the time agreed upon.	3.55	4.36
154	Some manual skills will be developed as usual with support of IT.	3.73	4.18
155	Online courses will be available in many different languages with access from all over the world.	3.82	3.82
156	Government funded higher education will start to privatize.	2.82	3.55
157	Internet will be main media for delivery of education.	3.09	4.00
158	Higher education will return to its traditional core purpose of research.	3.45	3.45
159	In Europe (EU) many students will learn with and from each other in international collaborations.	4.00	3.91
160	Teachers will need to develop coaching/mentoring skills	4.55	3.73
161	Learning methods will gradually change over one's life time: from being instructor led to learner led	4.09	3.36
162	Primary education will accept a larger pedagogical role: Learning to Learn rather than learning the complete subject domains like nowadays.	4.27	3.27
163	Students will learn increasingly globally.	4.00	3.91
164	Practice will become a focus for learning	4.00	3.55
165	Natural role of the teacher will be mediator of learning.	4.18	3.36
166	Augmented reality applications will be a major tool for learning,	3.00	3.18
167	Information will be available in many different forms, not only multimedia but connected media via mash-ups.	3.55	4.18
168	Learning should be social and supported by social web technology.	3.91	3.91
169	Educational institutions will be driven by interests of society.	4.27	3.45
170	Education will leverage the technology advancement	3.91	3.36

No.	Statements	Criteria	
		Impor-tance	Feas-ibility
171	There will be specialized (commercial) organizations for brush-up courses.	2.82	3.64
172	Social and cognitive processes and convergences will become part of the pedagogical methods.	4.45	3.36
173	Learning will be more integrated with daily life or work.	4.45	4.18
174	Personalized educational contents which meet learners job requirements.	4.27	3.82
175	Education will continue to support the need for a highly qualified work force.	4.09	3.91
176	Open learning through the internet will become common.	4.00	4.18
177	Students will obtain online profiles (and kudos) in their institutions.	3.55	3.91
178	Technology-enhanced learning should be basic requirement skills for every learner.	3.64	3.91
179	The learner will invest more in the cerebral aspects of learning: Strategic, problem-oriented, situational and creativeness.	4.27	3.18
180	Higher Education institutions will merge cross borders in Europe.	4.18	3.73
181	The majority of teachers work online from home either freelance or for an online educational organization.	3.45	3.82
182	Courses will be available in different forms (text, online, mobile, teacher-based instructions).	4.09	4.27
183	Systems and services will be developed to allow mutual peer group learning between groups of interested learners.	4.36	3.91
184	Choices and flexibility around learning will be the norm, also in primary/secondary education.	4.27	3.36
185	Precious time of f2f contact will not be missed for activities that could be done in technology-mediated [environment].	3.82	3.82
186	Formal learning will become more episodic with people entering and leaving education at various points in their career path.	4.18	3.73
187	There will be digital library services.	4.00	4.82
188	Experiential and immersive learning will be the norm.	3.64	3.45
189	The role of institutions will change from being the single provider of learning opportunities that delivers a variety of services to being one of several institutions that delivers a specialised service only.	4.00	3.36
190	Schools will loose their function.	3.18	2.27
191	Private higher education organizations will have an increased market.	2.91	3.45
192	Schools will be places where students will go to learn techniques of handling information.	3.91	3.36
193	Learners will be expected to take control of their own learning.	4.45	3.27
194	Students will combine working and learning.	4.18	4.00
195	Cross-curriculum (inter-disciplinary) project activities will dominate the course design.	3.91	3.27
196	A study environment will consist of services that are not specific to education.	3.27	3.64
197	Different type of certifications will emerge that are not related to formal learning institutions.	4.27	3.55
198	Desktop conferencing will become used to keep in touch with peer students from abroad.	3.09	4.18
199	Drugs that enhance learning effectiveness will be (legally?) widely available and used as well.	2.55	2.73
200	Schooling will become a less important focus for learning as learning moves into the workplace, community and home.	4.00	3.00
201	Education should cater the functional needs of every citizen irrespective of age.	4.45	3.18
202	There will be internet and access to it everywhere and all around the globe, allowing learning to flow in all directions.	4.09	3.91
203	Services on the internet will serve as a study environment.	4.00	4.45

ANNEX 3: GO ZONE FOR ALL CLUSTERS



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Feasibility
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Importance
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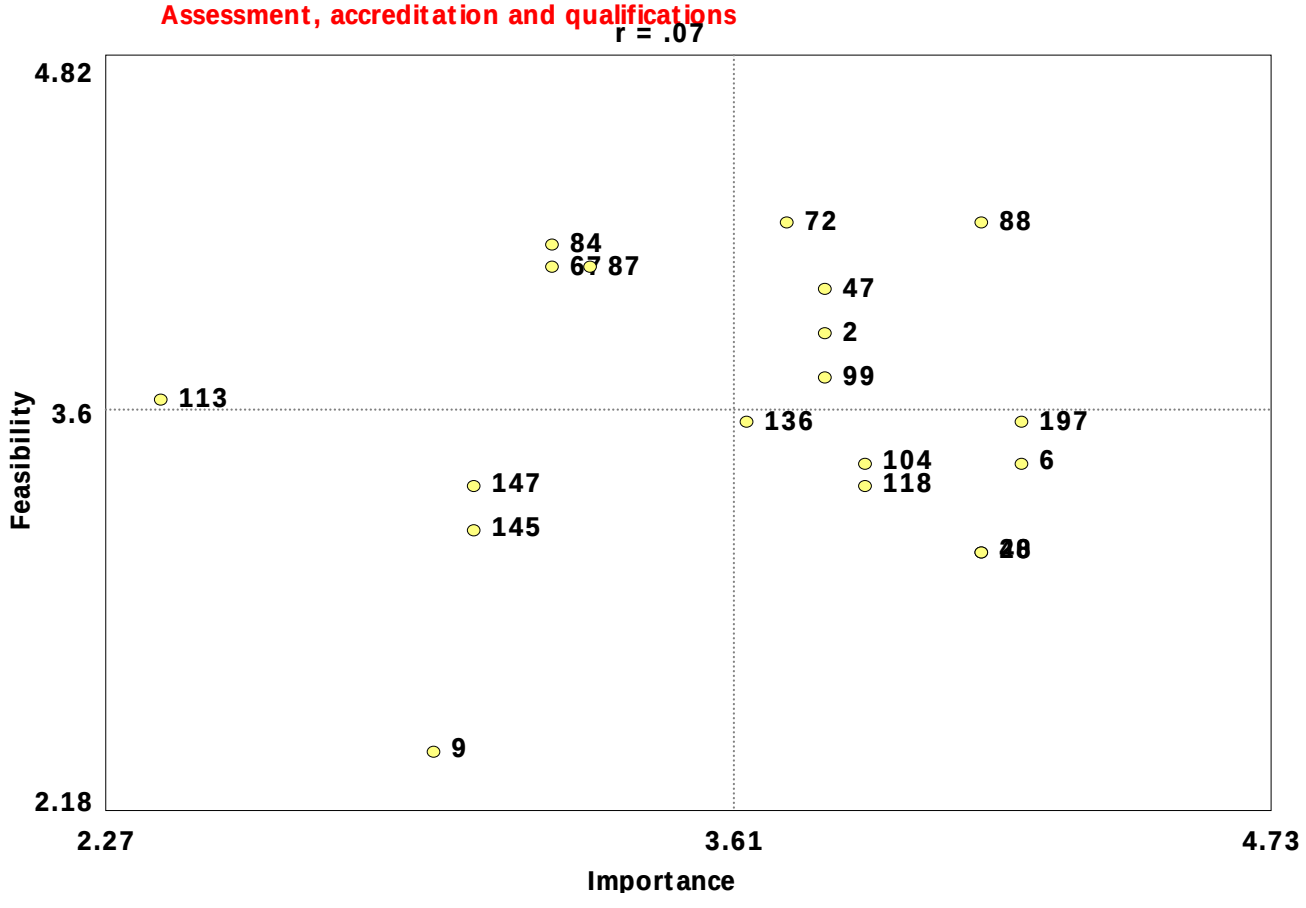
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Feasibility
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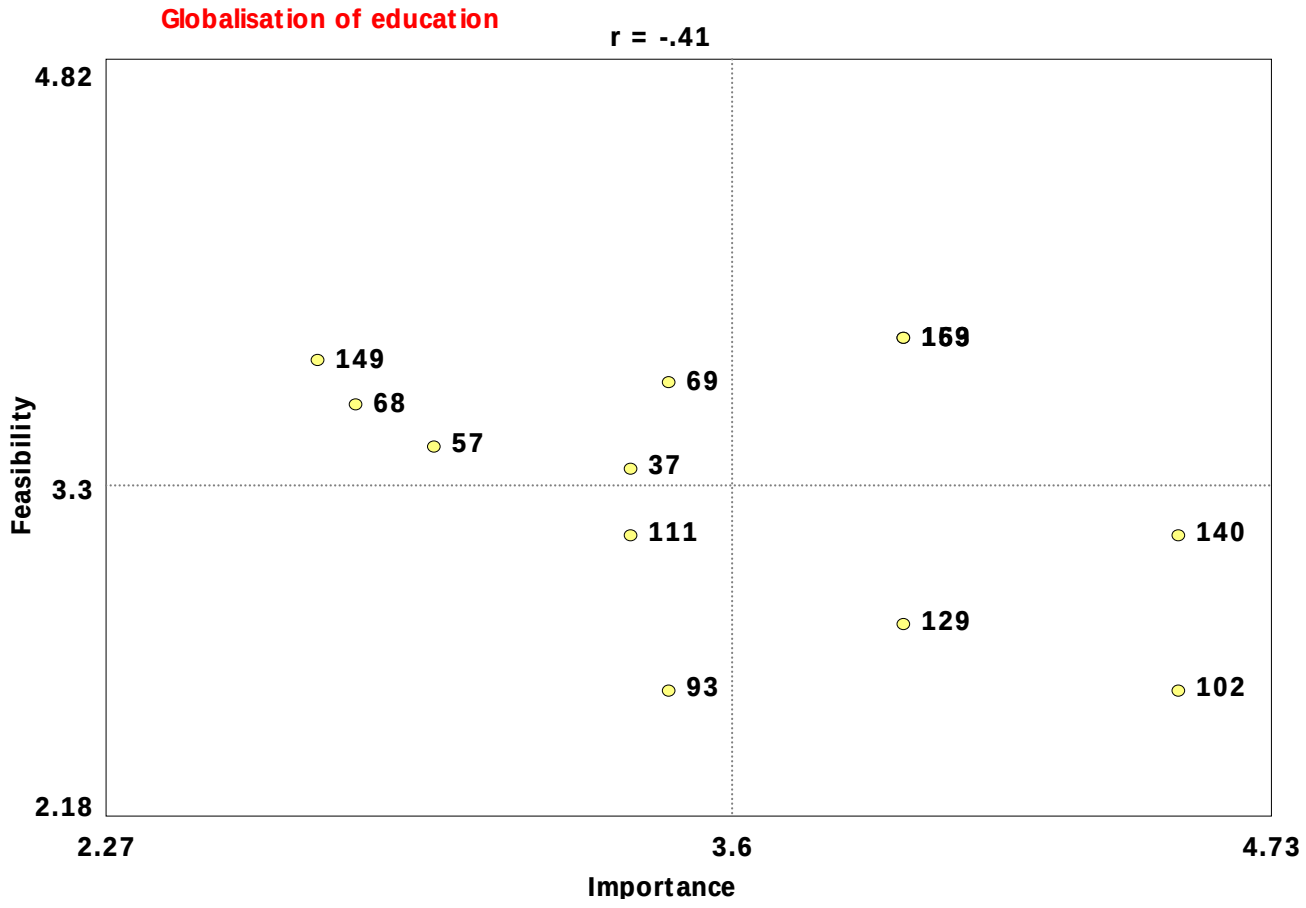
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Feasibility
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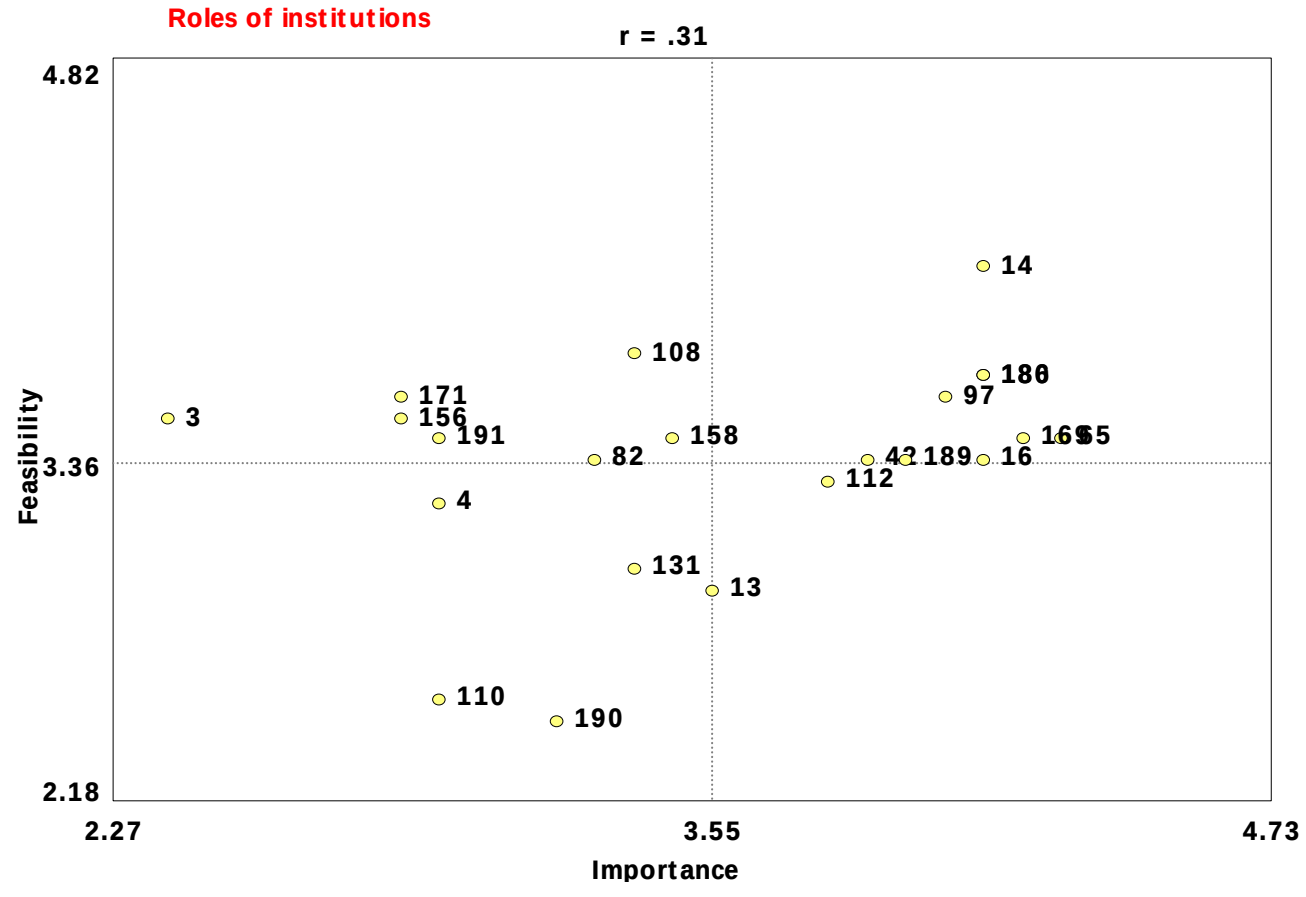
Importance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Feasibility
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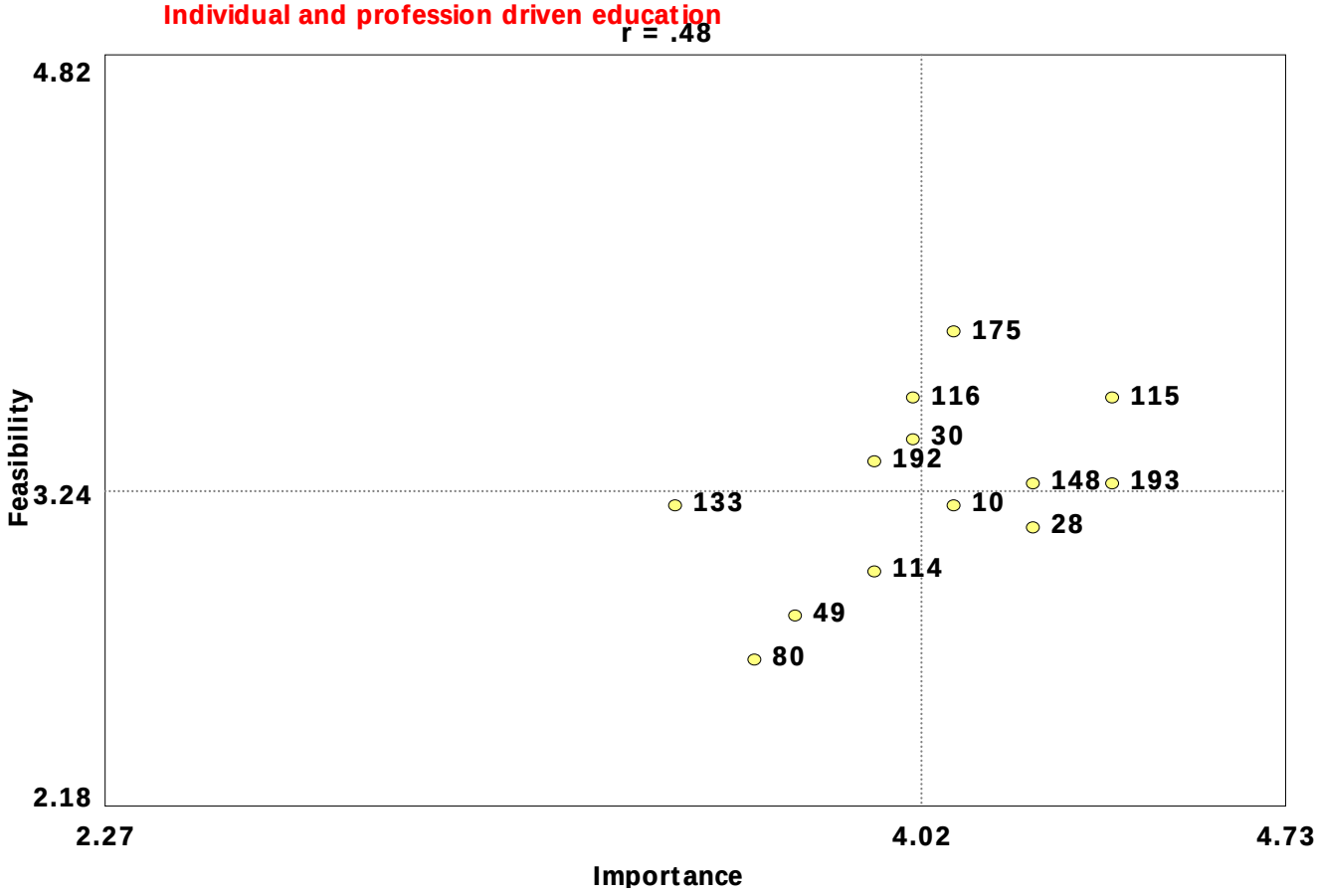
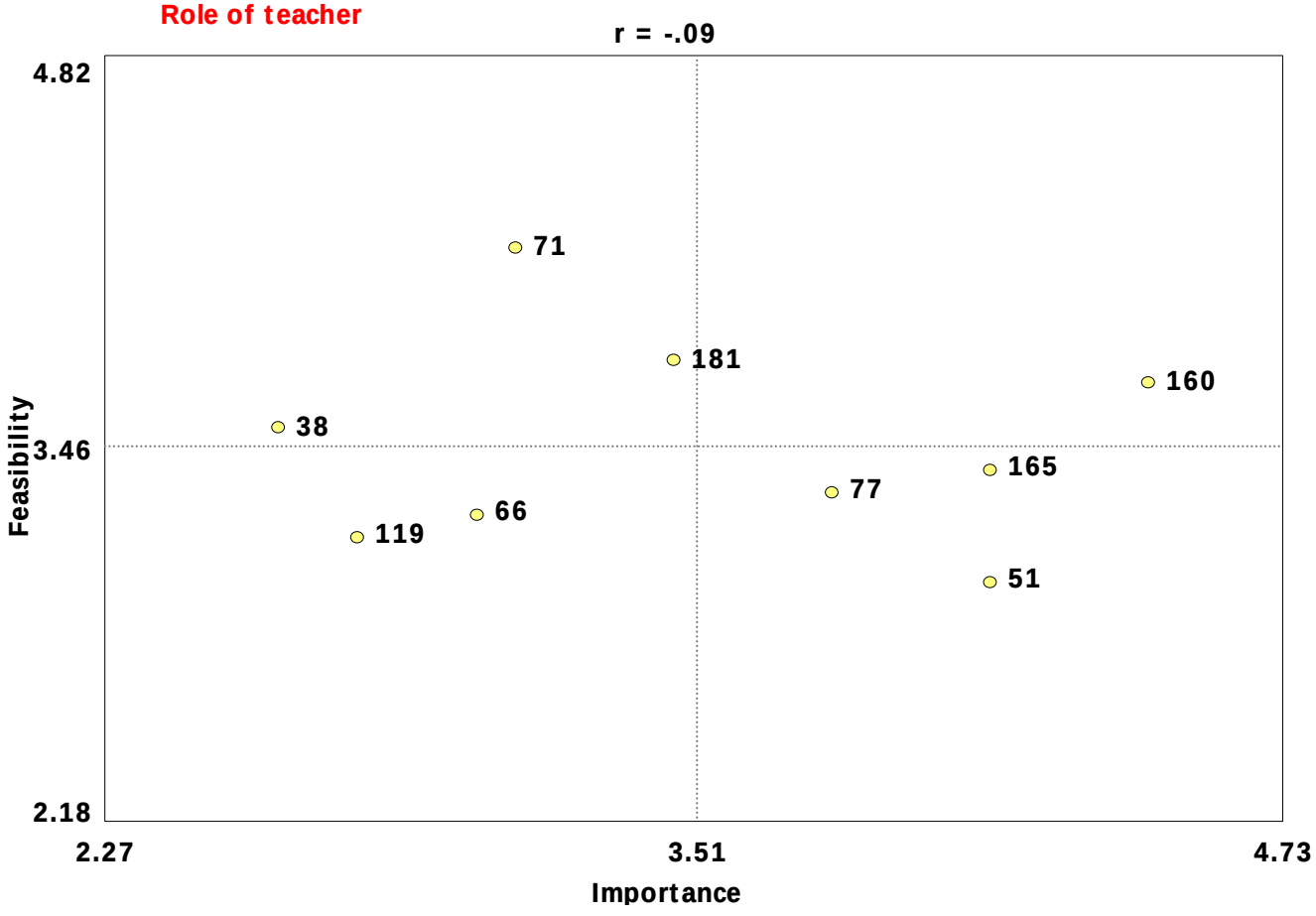
4.73
Importance

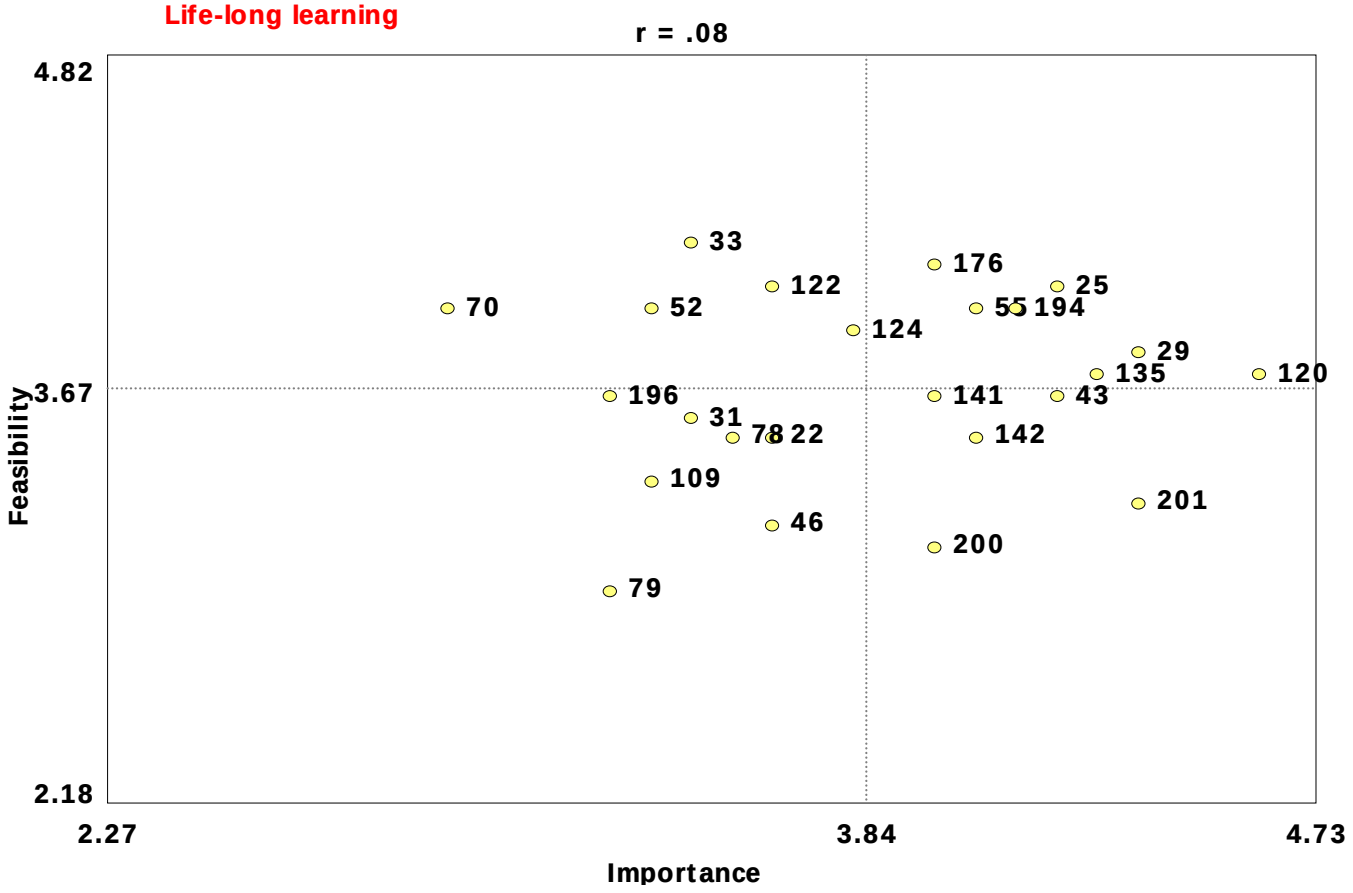
Individual and profession driven education



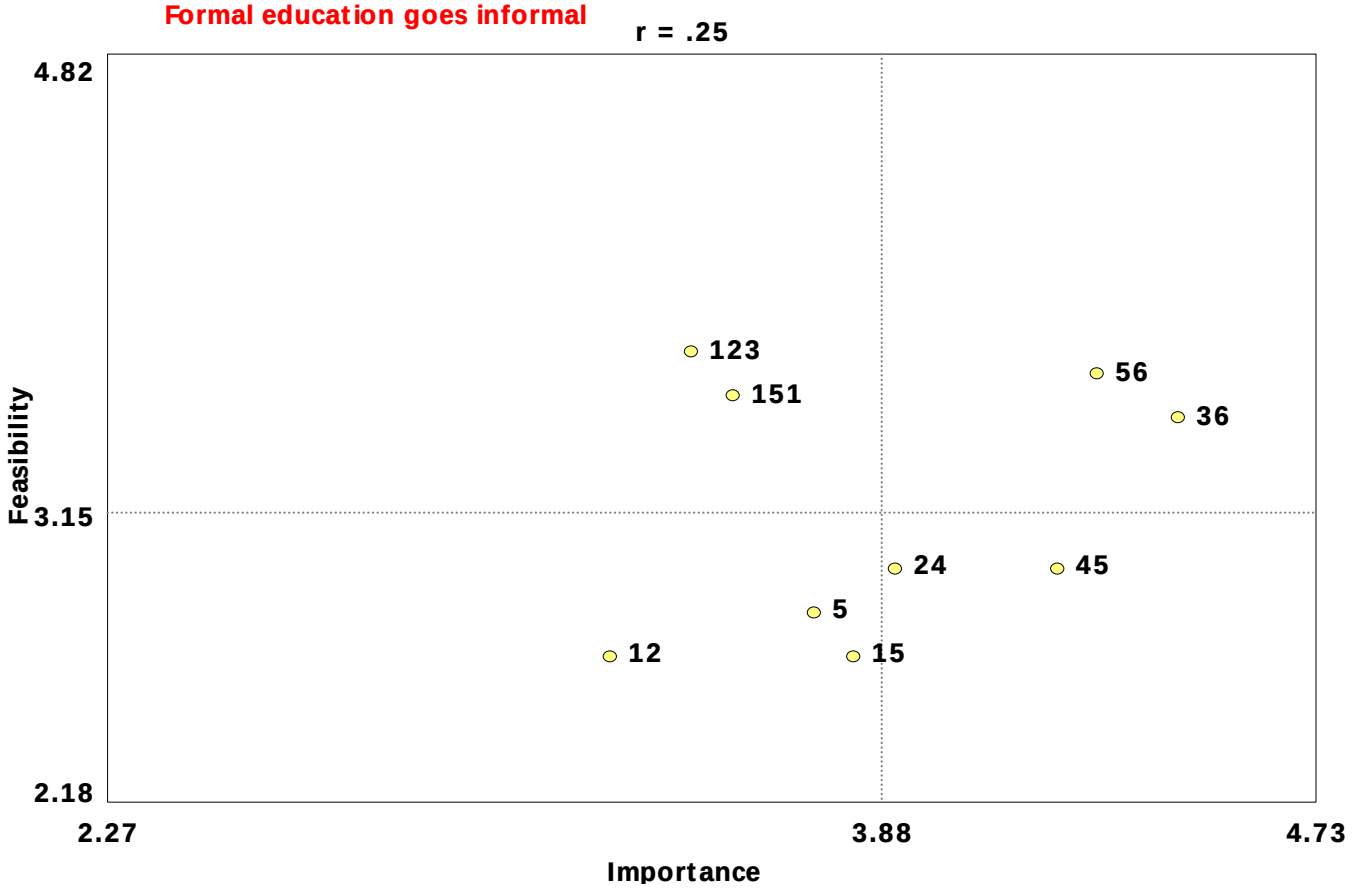
Role of teacher



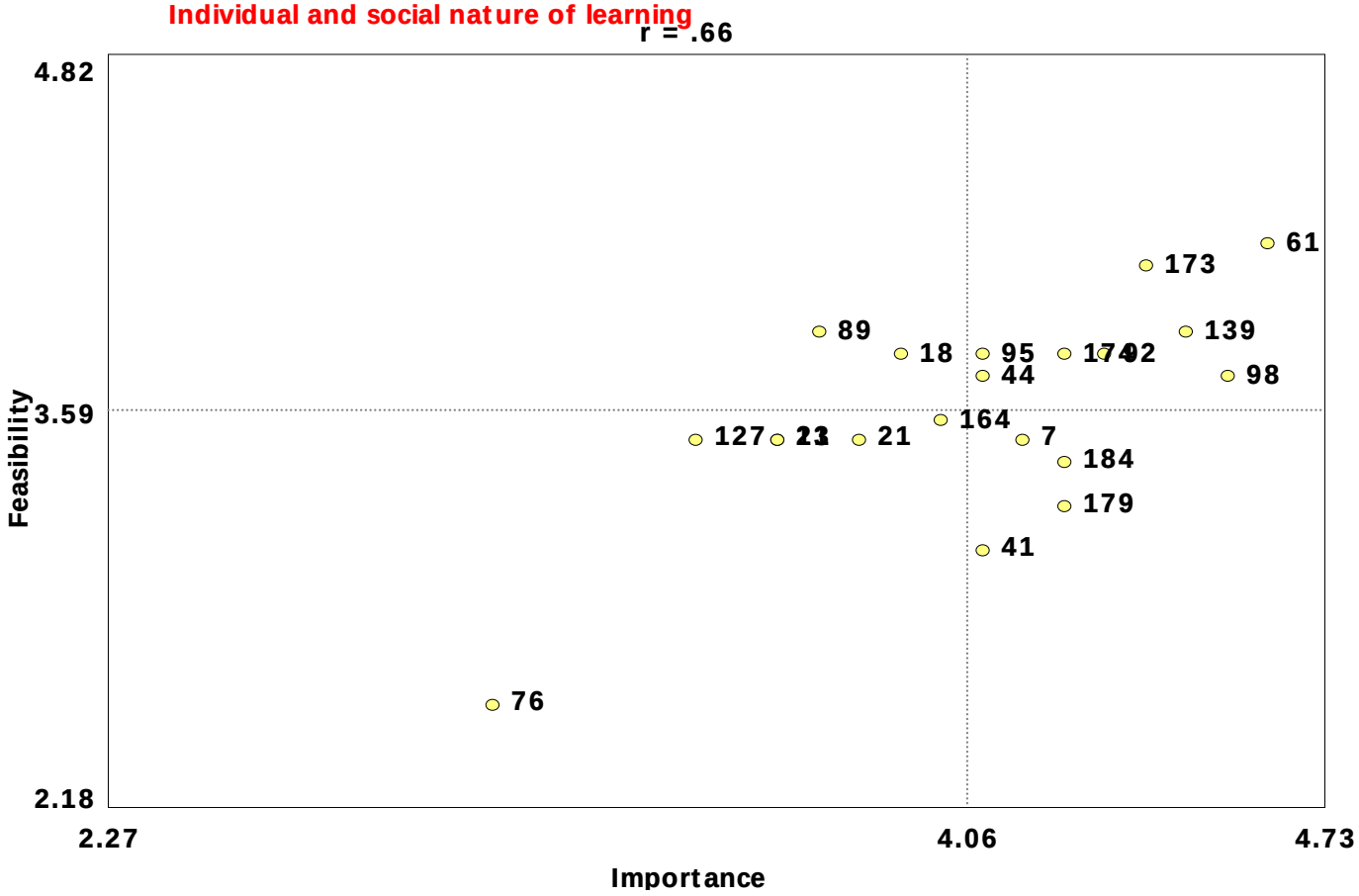
Life-long learning



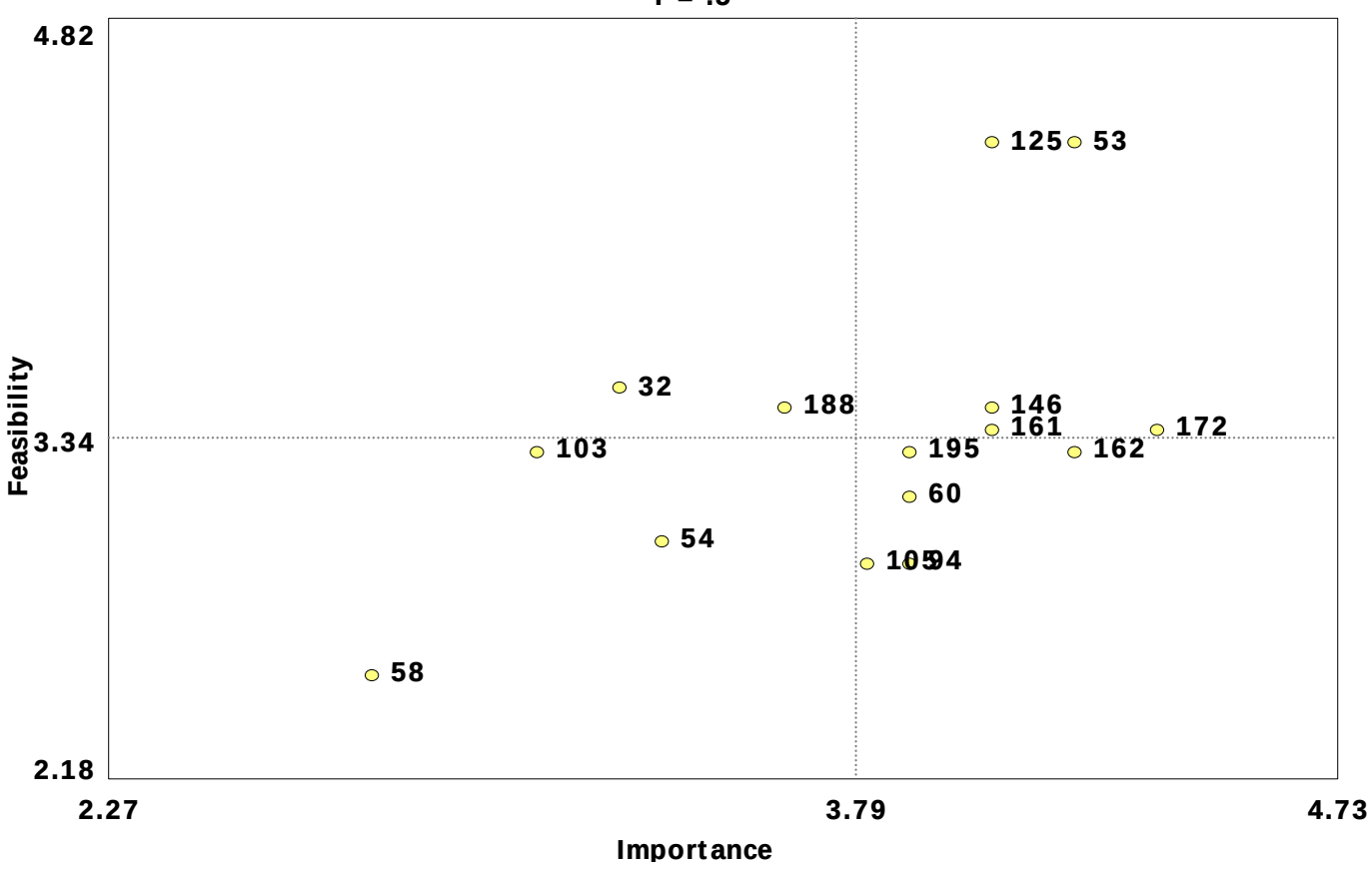
Formal education goes informal



Individual and social nature of learning



Epistemological and ontological bases of pedagogical methods



ANNEX 4: STATEMENTS WITH ABOVE AVERAGE IMPORTANCE AND FEASIBILITY RATINGS

No.	Statement	Criteria	
		Impor-tance	Feasibi-lity
2	There will be ways to get accredited for learning outside of formal institutions.	3,82	3,91
14	Higher Education institutions will expand cross borders in Europe.	4,18	4,18
18	Learner will teach other participants in process of learning.	3,91	3,82
19	Online social networking will become more important.	3,82	4,45
25	The workplace will become a major context for learning.	4,27	4,09
27	The growing role of media for improving cognitive performance will support the learner with facts and simulation outcomes.	3,82	4,09
29	We will have to develop skills in picking up relevant learning resources from what is abundantly there and building our own learning trajectories around them.	4,45	3,82
34	Technology will bridge time and space in learning.	4,00	4,45
43	It will become common for people to move between occupations with learning key to supporting such moves.	4,27	3,64
44	Learning at all levels will be closer connected to practice.	4,09	3,73
47	Qualifications will be checked and maintained on a European level.	3,82	4,09
53	Guided learning in a group will be complemented with learning in and from loosely knit networks.	4,27	4,55
55	University students will attend uni courses within their working schedule.	4,09	4,00
56	Online teaching universities will provide centres for skills development (skills labs).	4,36	3,73
61	Learning programmes will be more flexible then they are now.	4,73	4,27
63	Open Educational Resources will become widely adopted.	4,36	4,09
72	Most (educational) content will be digital.	3,73	4,36
86	Electronic learning environments will have greatly increased possibilities.	3,91	4,09
88	There will be an abundance of easily available learning resources, but a challenge [is] to find guidance around them.	4,18	4,36
89	Personal Learning Environments will replace institutional Virtual Learning environments.	3,73	3,91
92	The pedagogy of learning will change throughout one's life time, from fit for children to fit for adults	4,36	3,82
95	Learning will be much individualized.	4,09	3,82
97	Inter sector and inter subject networks of institutions will combine to form networks based on purpose and interest.	4,09	3,64
98	Education will be more personalized.	4,64	3,73
99	Continued education, assessment of certificates of acquired knowledge/skills/competences by standard educational framework.	3,82	3,73
106	The role of ICT will change throughout one's life time, from a supporting role to an overriding, unavoidable presence (wearable computers, in one's ordinary functioning integrated).	3,82	3,73
107	Online communities will be widely used in education.	3,73	3,82
115	Learners will have more opportunities to find co-learners who share their learning goals and preferences (similarly to finding people to travel together).	4,45	3,64
116	Networked education settings rather than centralized educational institutes.	4,00	3,64
117	Knowledge-based society would mean access and sharing of knowledge with technology support.	3,82	3,64
120	Lifelong learning will be natural.	4,73	3,73

No.	Statement	Criteria	
		Impor-tance	Feasibi-lity
124	The learning environment will change throughout one's life time, from school to workplace and home	3,82	3,91
125	Constructivism will still be there, but a new paradigm will have arisen.	4,09	4,55
128	Context specific learning materials and tasks will lead to more localised learning.	3,82	3,73
135	Education and learning will last throughout one's whole life, from cradle to grave so to speak, going from Kindergarten age to being a senior citizen.	4,36	3,73
139	Study paths will become more flexible.	4,55	3,91
141	The learning environment will change throughout one's life time, from knowledge transfer and socialization to knowledge independent knowledge acquisition and voluntary social interaction	4,00	3,64
144	Learning on the move (anytime and anywhere).	3,73	4,18
154	Some manual skills will be developed as usual with support of IT.	3,73	4,18
155	Online courses will be available in many different languages with access from all over the world.	3,82	3,82
159	In Europe (EU) many students will learn with and from each other in international collaborations.	4,00	3,91
160	Teachers will need to develop coaching/mentoring skills	4,55	3,73
163	Students will learn increasingly globally.	4,00	3,91
168	Learning should be social and supported by social web technology.	3,91	3,91
173	Learning will be more integrated with daily life or work.	4,45	4,18
174	Personalized educational contents which meet learners job requirements.	4,27	3,82
175	Education will continue to support the need for a highly qualified work force.	4,09	3,91
176	Open learning through the internet will become common.	4,00	4,18
180	Higher Education institutions will merge cross borders in Europe.	4,18	3,73
182	Courses will be available in different forms (text, online, mobile, teacher-based instructions).	4,09	4,27
183	Systems and services will be developed to allow mutual peer group learning between groups of interested learners.	4,36	3,91
185	Precious time of f2f contact will not be missed for activities that could be done in technology-mediated [environment].	3,82	3,82
186	Formal learning will become more episodic with people entering and leaving education at various points in their career path.	4,18	3,73
187	There will be digital library services.	4,00	4,82
194	Students will combine working and learning.	4,18	4,00
202	There will be internet and access to it everywhere and all around the globe, allowing learning to flow in all directions.	4,09	3,91
203	Services on the internet will serve as a study environment.	4,00	4,45

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Technical Note

Abstract

This report presents the findings of a structured and targeted expert consultation exercise which aimed to identify, cluster and rate the main changes in education and training expected to occur over the course of the next 20 years. The exercise employed the group concept mapping methodology to generate, sort and rate more than 200 statements by a group of 13 experts.

The emerging map of future changes to education and training can be divided into a set of 12 thematic clusters, ranging from technological changes over globalisation to changing pedagogical concepts. Anticipated changes that rate particularly high in importance according to experts include learner-centred, flexible and personalised approaches to learning; the integration of learning into life and work; and the development and implementation of innovative pedagogical concepts. When comparing the cluster ratings on importance and feasibility, it becomes clear that, while experts are optimistic concerning the development of technology enhanced learning opportunities, scepticism prevails concerning the feasibility of implementing learner-centred approaches in formal education and, in general, the ability of formal education systems and institutions to keep pace with change and become more flexible and dynamic.

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