Bart Rienties[a,]*, Wolter Kaper[b], Katrien Struyven[c], Dirk T. Tempelaar[d], and Leendert van Gastel[b], Sanne Vrancken[c], Magdalena Jasińska[e], Eglė Virgailaitė-Mečkauskaitė[f],

[a]University of Surrey, United Kingdom; [b]Universiteit van Amsterdam, the Netherlands; [c]KU Leuven, Belgium; [d]Maastricht University, the Netherlands, [e]Maria Curie Skłodowska University, Poland Poland; [f]Šiauliai University, Lithuania.

Corresponding author. Email: b.rienties@surrey.ac.uk

A review of the role of ICT and course design in transitional education practices

An increasing number of higher educational institutes are offering remedial, bridging, preparatory or transitional courses in a blended and online format to remediate and enhance students' knowledge and skills. This paper addresses how teachers and institutes design and implement these courses. The descriptions of transitional courses were collected by means of an online questionnaire and results were stored in a searchable online database. In the questionnaire consisting of 38 closed and open-ended questions, teachers had to indicate their content, context, organisation, pedagogical approach, assessment method and ICT use. During February-May 2009, 118 course descriptions and implementations were collected. These 118 course descriptions were analysed with the aim of describing their main educational scenarios using multiple correspondence analysis and two-step clustering analysis. The results indicate that courses can be explained by five dimensions: 1) ICT; 2) Mathematics versus language; 3) Lower versus higher Bloom levels; 4) Gamma sciences versus others; and 5) Very small group size versus others. Afterwards, the courses were positioned into six distinctive clusters. An important finding of this study is that teachers seem to design and implement fairly similar course designs when content, context and pedagogical approach are given. Furthermore, teachers' choices about ICT use are not yet systematically and consensually linked to content and pedagogical choices.

Keywords: ICT; Course design; pedagogical approach, role of teacher; multi-method approach

Introduction

In an increasingly globalising world, businesses are looking for excellent graduates with international experience and state-of-the-art knowledge and skills (Van der Wende, 2003). An increasing number of students is studying abroad in order to acquire international experience and to increase their attractiveness for international companies (Rienties, Grohnert, Kommers, Niemantsverdriet, & Nijhuis, 2011; Rienties & Tempelaar, 2009). For example, in Europe the number of students that are studying at a higher educational institute outside their home country has increased with 57% from 327.500 in 1998 to 515.400 in 2006 (EUROSTAT, s.d.).

This increased heterogeneity of enrolments in higher education has an unquestionable impact on transitional problems. Common transitional problem areas for students are found in mathematics, language, research methods or intercultural skills. In fact, there is a growing concern among educators and policy makers that learners – foreign and local – are not well-prepared to start a bachelor or master programme (Jindal-Snape, 2010).

As a result, an increasing number of higher educational institutes is tackling these transitional problems by designing remedial courses, transitional courses, summer courses, developmental courses or preparatory courses, to equip learners with required knowledge, skills and competences before entering a higher education programme (Attewell, Lavin, Domina, & Levey, 2006; Bettinger & Long, 2005; Brants & Struyven, 2009; Brouwer, Ekimova, Jasinska, Van Gastel, & Virgailaite-Meckauskaite, 2009; Rienties, Tempelaar, Van den Bossche, Gijselaers, & Segers, 2009; Tempelaar, Rienties, & Giesbers, 2009). Remedial education is a common approach to prepare students both academically and socially during the early stages of college and university (Attewell, et al., 2006; Bettinger & Long, 2005). Differences in cognitive demands, nature of tasks, self-regulation, the amount of self-study, and discovery learning required in higher education settings are pinpointed as causes for a need for transitional education (Conley, 2007; McCabe & Day, 1998).

In the United States 98% of 2-year public colleges and 80% of public institutions offer at least one remedial course in reading, writing or mathematics (Attewell, et al., 2006; Boyer, Butner, & Smith, 2007; Kozeracki, 2002). Mathematics is the most common remedial subject, followed by reading and writing (Attewell, et al., 2006; Merisotis & Phipps, 2000). Regarding the context of remedial coursework, courses can be characterised as either embedded in the regular academic programme or separate from the programme; for example prior to a given programme in the form of summer schools (Brants & Struyven, 2009; Brouwer, et al., 2009; Rienties, Tempelaar, Dijkstra, Rehm, & Gijselaers, 2008; Rienties, et al., 2009; Roueche & Roueche, 1999; Tempelaar, et al., 2009).

Remedial courses are not only organised in face-to-face settings. Often for practical reasons transitional courses are offered in an blended or distance format (Brants & Struyven, 2009; Rienties, Tempelaar, Waterval, Rehm, & Gijselaers, 2006). Information Communication Technology (ICT) has powerful Web 2.0 tools that might benefit learners. In fact, ICT has gained the power to support independent learning as well as to learn irrespective of time and geographical constraints with the wide-spread implementation of Internet

(Bryant, Khale, & Schafer, 2005; Lou, Bernard, & Abrami, 2006; Resta & Laferrière, 2007; Wheeler, 2007). Using internet technologies, learners can follow individually tailored blended or distance courses such as mathematics (Brouwer, et al., 2009), statistics (Tempelaar, et al., 2009) or accounting (Bryant, et al., 2005) while being off-campus. This enhances the flexibility of learners to combine work, internship or holiday with study, which is of great value in transitional courses. Besides enriching independent learning experiences for learners, recently several powerful ICT tools and methods for learning in collaborative settings have been developed where learners work and learn together (Järvelä, Järvenoja, & Veermans, 2008; Jonassen & Kwon, 2001; Resta & Laferrière, 2007; Schellens, Van Keer, De Wever, & Valcke, 2009; Wang, 2009). Recent research on transitional education using ICT has highlighted that in particular the interactivity, adaptivity and possibilities of rapid feedback of ICT tools and interactive learning environments are important merits when students are not able to come to college or university or when students have large knowledge or skills gaps (Brants & Struyven, 2009; Rienties, et al., 2009; Rienties, et al., 2006; Tempelaar, et al., 2009; Wieland et al., 2007). However, according to Wang (2009, p. 1), the advantages of more student-centred, engaging and reflective interactive and collaborative learning environments "do not happen spontaneously unless the learning environments are thoughtfully designed".

The role of the teacher in creating and facilitating an interactive learning environment is widely acknowledged as being one of the core elements of successful blended and online learning (De Laat, Lally, Lipponen, & Simons, 2007; Löfström & Nevgi, 2008; Mazzolini & Maddison, 2003). Several researchers (Garrison, Anderson, & Archer, 1999; Järvelä & Häkkinen, 2002; Kirschner, Strijbos, Kreijns, & Beers, 2004; Koehler & Mishra, 2005; Mishra & Koehler, 2006; Resta & Laferrière, 2007) have addressed that an effective educational design using ICT should involve cognitive, pedagogical, social and technological elements. In a range of studies on effective blended and online course designs, Mishra and Koehler (2006) found that teachers should carefully balance and integrate their cognitive, pedagogical and technological knowledge when designing and teaching blended or online courses. In a study among 27 novice teachers who followed an e-learning training program, Löfström and Nevgi (2008) indicate that the pedagogical awareness of these teachers with respect to ICT was well-established. However, in many courses that are adjusted into blended or online settings teachers commonly add an ICT tool or use an ICT tool with a particular purpose without adjusting the cognitive content and/or pedagogical approach of the course (Mishra & Koehler, 2006; Resta & Laferrière, 2007). As a result, the learning experience of students following the online version of the course might be less rich than students following a face-to-face course (Järvelä, et al., 2008; Jonassen & Kwon, 2001).

In a review of 20 years of Computer-Supported Collaborative Learning research, Resta and Laferrière (2007, p. 76) recommend that “research is needed on the organisational issues related to implement CSCL in higher education to determine the essential conditions that must be in place for effective faculty use of CSCL”. Furthermore, given the complex nature of blended and online learning, several researchers (De Laat, et al., 2007; Hurme, Palonen, & Järvelä, 2007; Järvelä, et al., 2008) recommend to analyse effective course designs using an integrated multi-method approach. In line with these recommendations and the urge of Resta and Laferrière (2007) and others to assess the role of ICT in real-world educational settings, this paper addresses how teachers design and implement interactive learning environments using ICT in face-to-face, blended and distance education. In particular, we will review the design and implementation of cognitive, pedagogical, social, organisational and technological course elements in 118 transitional courses using a multi-method approach. The research questions are:

(1) What are the main dimensions along which transitional courses differ from each other?

(2) What constellations of content, context, organisation, pedagogical approach, assessment, ICT usage often co-occur and can therefore be considered tested or 'good' practices?

Methods

Sample and data collection

An online questionnaire was built based upon an extensive literature review (Brants & Struyven, 2009), needs-analysis and experience from several projects on transitional education (Rienties, et al., 2008; Rienties, et al., 2006). The six key factors of transitional education (content, context, organisation, pedagogical approach, assessment, ICT usage) were integrated into a questionnaire of 38 open and closed questions. The questionnaire was distributed via the EARLI (EARLI, 2009a, 2009b) and EDINEB network[i] to teachers, designers and organizers of transitional courses, with an open invitation to share their course designs. A total of 118 transitional courses reported by 84 respondents from 65 institutions and from 22 countries were gathered in the period February-May 2009, whereby a distinction was made between face-to-face, blended and distance education settings. For each of the eight categories below there was an open field in which respondents could add explanations to their standardised answers. Furthermore, there were separate open fields for providing comments, and a rationale for the transitional activity as a whole.

(1) *Identification*: country, organising institution, course name, name and email address of the respondent. Respondents could indicate whether they wanted their course design to be publicly viewable on the web (75 out of 118 gave permission)[ii].
(2) *Content*: discipline and skills taught during the course, aim(s) of the course (reviving forgotten knowledge, learning new knowledge), flexibility of the course content.
(3) *Context*: the scheduling of the transitional course relative to the regular higher education program was probed: is the course scheduled before the start of the program (e.g. summer course), or in parallel to it? In case of parallel scheduling, it was asked how the transitional activity was related or integrated with the regular program.
(4) *Organisation*: who organises the course (university staff or a commercial party)?; was special funding available for developing and implementing the course?; do students pay for participation?; is attendance of the course obligatory?; what was the number of students attending the course?; is it distance, blended or face-to-face learning?
(5) *Pedagogical approach, including support*: work-format (individual, collaborative, both), types of individual tasks (exercises, presentations, ...), types of group tasks (discussions, projects, ...), instructional support (teacher, peers, digital tutor, ...).

(6) *Assessment*: the timing (before, after, during the transitional activity), the purpose (formative, summative, both), the form (exam, essay, ...), the adaptivity of assessment was questioned. In addition, respondents were asked to indicate to what extent the assessment focussed on knowledge and skills.
(7) *ICT use*: for a range of possible purposes respondents had to indicate whether ICT was used and for that purpose or not. Furthermore, a collection of ICT tools was presented, with checkboxes to indicate whether these tools were used.
(8) *Evaluation*: there was one open text field in which respondents could share their evaluation of the course. Respondents were left free to either give personal impressions, cite formal evaluation results such as documents of evidence or providing references to publications.

Data analysis

The data were analysed using a multi-method approach. First of all, a Multiple Correspondence Analysis (MCA) was used to provide an answer to the first research question: to find the most important dimensions on which transitional courses in our database distinguish. MCA is the categorical data analogue of factor analysis or principle component analysis for quantitative data. MCA determines the independent dimensions that explain most of the variation in the dataset. Like in factor analysis, these dimensions are constructed to be independent, are characterised by a decreasing contribution in the explanation of total variation, and an eigenvalue criterion is used to decide on the number of dimensions. MCA takes its name from the fact that it portrays the correspondence of categories of variables.

To elaborate the second research question as to which constellations of content, context, organisation, pedagogical approach, assessment, and ICT usage often co-occur, cluster analysis was applied. Of the three general approaches to cluster analysis, hierarchical, K-means, and two-step clustering, the last approach is most suited for categorical data. Therefore, we applied two-step clustering to assign all courses to clusters based on similarity, with Schwarz's Bayesian criterion (BIC) as the clustering criterion, and log-likelihood as the distance measure. The clustering could have been applied to the raw data, but anticipating the results of the MCA, that provide evidence that a substantial part of the variation in the data is adequately expressed by using only five independent dimensions instead of the original 68 variables, a two-step clustering procedure, where the clustering takes place with regard to the dimensions produced by the MCA, was regarded as most appropriate.

Finally, a content analysis was conducted on the eight category evaluation as well as other open text fields. First of all, three general approaches were brought forward by the respondents in order to provide evidence of the effectiveness of their course design and implementation (i.e. students' response based upon evaluation questionnaire or interview, respondent's opinion, proof of effect of intervention in form of data or publication). This investigation started from the assumption that respondents would by and large report transitional practices that they were proud of and satisfied with. It was not to be expected that an equally good sample of negatively evaluated courses would be obtained. Therefore, our idea was to regard all clusters found as good practices, until the opposite is proved. In total 21 course descriptions included students' responses, 21 course descriptions included the respondent's or teacher's opinion, 36 course descriptions included multiple opinions from stakeholders (students, teachers, management, etc.) and 4 were uncodeable. Afterwards, all evidence provided by the respondents to proof their good practice was categorised on a 4-point scale (negative, moderately negative, moderately positive, positive) by an independent coder who is a trained educational psychologist. For each of the clusters we checked if being a member of that cluster correlated with course evaluation. In addition, for each of the MCA dimensions we checked the correlation with course evaluation using Spearman's rho correlation.

Results

Descriptive statistics of purpose of ICT usage

In Table 1, the purpose of usage of ICT in face-to-face, blended and distance transitional education is illustrated. On average, in transitional face-to-face education ICT is used for 2.6 purposes, whereby standard deviations in Table 1 are illustrated in brackets. In the 46 face-to-face education courses in our database, ICT is primarily used for storage (e.g. course materials, lecture materials) and communication with students (e.g. announcements, emails). In total 4 respondents indicated not to have used ICT in their face-to-face education. In total 47 courses are identified by respondents as blended education, where part of the educational experience of students takes place outside the class-room. On average, ICT is used for 5.8 purposes in blended transitional courses ICT is primarily used for communication, storage, submitting (i.e. assignments), web-searches and collaboration (with peer-students and teacher). Finally, 26 course descriptions are identified by respondents as distance education, whereby on average ICT is used for 6.3 purposes. In the majority of transitional courses in distance education ICT is intensively used for storage, assessment, feedback after tests communication, submitting and tests. Except for ICT for presentations and ICT for other purposes, significant differences are found between the three forms of education using a Chi-Square test as is shown in Table 1. In general, when transitional education is designed in a distance-learning format, ICT is used for more purposes than blended and face-to-face education and the role of ICT in assessment and feedback is considerably more important.

Insert Table 1 about here

Dimensions for describing transitional teaching practices

Although Table 1 indicates that teachers have different purposes for ICT usage when courses are taught in face-to-face, blended or distance education, a more complex analysis is needed in order to distinguish the cognitive, pedagogical, social, organisational and technological elements in the course design and implementation. Therefore, a Multiple Correspondence Analysis (MCA) was conducted on the 118 transitional courses. The MCA resulted in a five-dimensions solution that explained 47% of variation of our data. The decision to ignore higher dimensions was based on Cronbach's alpha (0.73 for dimension 6, and lower for the higher ones), as well as on the result that total explained variation is only slowly increasing for dimensions higher than five (about 4% extra explained variation for each added dimension). The dimensions found were interpreted by reviewing the variables that correlate highly or exclusively with each of the dimensions, and by checking significance of correlations (chi-square test, $P < 0.05$) between such variables (Michailidis & De Leeuw, 1998). In the cluster analysis, the optimal number of clusters was found to be four. However, one of these four clusters had an unclear profile and contained half the courses in our sample. Therefore, a clustering into 5 and 6 clusters was forced. The quality of the obtained clusters was checked by plotting the clusters in the first two dimensions as revealed by MCA and requiring that clusters have clear boundaries in the MCA picture (See Michailidis & De Leeuw, 1998). Using that same criterion, a clustering into seven or more clusters was rejected. The five dimensions that are characterised with decreasing contribution to variance (V) from the MCA can be interpreted as follows:

(1) *ICT: less versus more ICT* (V = 15%). From the 68 variables in our questionnaire, 30 can be a priori classified as being about ICT. From these, 25 have their main component along this dimension. Reversing the argument: there are 11 variables that point "almost purely" along this dimension (the next component is at least a factor 3 smaller) and all of those are about use of ICT. We conclude that this dimension measures use of ICT: on one side are 37 courses that use little ICT tools and 4 courses that use no ICT tools in their education and primarily use traditional face-to-face education tools like paper and pencil. On the other side there are 58 courses that intensively use ICT tools, in the middle are 19 courses that integrate ICT tools with face-to-face education tools, as was found in Table 1.

(2) *Mathematics versus language* (V = 11%). This dimension is related to the content and the pedagogical approach of courses: 22 Mathematics courses are at the negative end of this scale, 57 courses teaching a specific language are at the positive end, while 39 courses are located in the middle. This finding is in line with research on remedial education, whereby mostly mathematics, language and writing courses are given (Attewell, et al., 2006; Brants & Struyven, 2009; Rienties, et al., 2008). This content aspect correlates with a number of didactical decisions: the negative half of the scale correlates with individualised pedagogical approaches, individualised course content, and distance learning. The positive half correlates with work forms involving collaboration, course content differentiated according to subgroup, non-distance learning. One organisational variable plays a role: courses on the negative half of the scale more often have funding.

(3) *Bloom levels: lower versus higher* (V = 9%). 11 courses are positioned on the negative half of this axis tend to have: assessment focused on knowledge; exercises done individually; content is adapted for subgroups; assessment is done for summative purposes; and a commercial institute (instead of a higher educational institute) is often organising such a course. These courses possibly aim at realising higher educational institute entrance requirements in a short time. Therefore, they are more often scheduled before the regular higher educational program. At the middle of the scale are 41 higher educational institute-organised courses that are less focused on knowledge, less individual exercises, content is not adapted to subgroups, scheduling is more often during the regular study program and assessment is less often summative. Finally, 66 courses on the positive half of this axis tend to be positioned in the regular study program. We might interpret that these courses have less time restrictions and therefore more freedom in choosing work formats that cater also to the higher Bloom levels (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956).

(4) *Gamma sciences versus others* (V = 7%). This dimension separates the social-, business and managerial sciences from the other disciplines: the 9 gamma science courses are on the positive side of the scale, 109 courses that are characterised as “other sciences” have their centre of gravity on the negative side. Courses at the positive half of the scale have assessments focusing less often on skills.

(5) *Group size: very small versus others* (V = 5%). This dimension separates a relatively small number of 17 courses far on one side of the scale, while the majority is close to the origin. The isolated small group has: very small group size (1-10 participants), collaborative work form, the transitional activity is optional and scheduled in parallel to the regular course that needs the skills, and assessment is less often done for formative reasons.

These results show that content or discipline taught is not a one-dimensional concept: two of the five dimensions (dimensions 2 and 4) found are strongly related to content. This is to be expected: why would mathematics, languages and gamma sciences fit to one dimension? In the same way: pedagogy appears not to be a one-dimensional concept, with pedagogical choices showing up in three of the five dimensions (dimensions 2, 3 and 5). Dimension "2. Mathematics versus language" shows many educational design choices correlating with the content aspect of this dimension.

Seeing that both content and pedagogy appear as multi-dimensional, it may come as a surprise that ICT-use appears as only one dimension: relatively many ICT related variables correlate with each other, using ICT for purpose X increases the likelihood of also using it for Y. However, ICT-related variables in general are not playing a prominent role in other dimensions than the first. The notable exceptions ($r > 0.3$ on other dimensions) are: the choice between distance learning, blended and face-to-face (dimensions 1 and 2), and the use of assessment in the form of a digital exam (stronger on dimension 2 than on 1), which was also found in the previous section.

The five dimensions presented above are ordered according to their decreasing contribution to the explained variation in our dataset. However, this ordering in itself is not to be viewed as a result, because it is in large part an artefact of the questions asked. For instance, the fact that the dimension "1. ICT, less versus more" explains the largest part of the variation reflects the number of questions asked about ICT, therefore reflects our research interests rather than being a result. The above observation about the ICT-variables mainly correlating among themselves, in contrast, is to be regarded as a result, because each of these ICT variables had the potential to correlate with e.g. each of the pedagogic variables, but only few of them did show such a correlation.

Six clusters of transitional courses portrayed

Our multi-method approach directed at understanding the design and implementation of interactive learning environments has two-step clustering (BIC) as the second tool. By the method described we arrived at a six cluster solution. In order to integrate both methods, we will interpret the six clusters in terms of their scores on the MCA dimensions. We will use the first four dimensions found by MCA to give an insightful presentation of differences between the clusters. The fifth dimension does not show a clear separation between any of the 6 clusters found. When we label all the courses with their cluster-number and afterwards plot all courses in the first two dimensions as revealed by MCA, the result is as in Figure 1. From Figure 1 we conclude that each of the clusters occupies its own region, with only limited overlap at the boundaries. This implies that teachers design fairly similar courses in a particular context, which depends on the course content (mathematics, language) and learning setting (face-to-face, blended, distance).

Insert Figure 1 about here

The number of courses in each cluster, as well as the number of countries involved, is shown in Table 2. Furthermore, in Figure 2, typical values for variables that turned out strong discriminators (r > 0.4 with one dimension or > 0.3 with two or more dimensions) during MCA for each of the clusters are given. In Figure 2, the clusters are again spread out in MCA-dimensions 1 and 2 (ICT and Mathematics vs. language), and those variables strongly related to these dimensions are highlighted, while the others (strongly related to dimension 3, 4 or 5, but not to 1 or 2) are shown in grey. For example, for cluster 6 *lower right* this implies that ICT is distinctively and intensively used in a collaborative distance setting for business education along dimension 1 and 2. Furthermore, the assessment of this cluster of courses is on individual knowledge exercises at a lower Bloom taxonomy dimension 3, while the assessment it not focussed on skills along the gamma science dimension 4.

Insert Table 2 about here

The six clusters found can now be characterised as follows, using as names their place in the MCA-dimensions 1 and 2 with respect to the origin (in clockwise order):

Insert Figure 2 about here
------

(3) *Left*. These 30 courses have in common that they use little or no ICT. Face-to-face teaching is the only teaching method. Furthermore, collaborative work is used relatively often. Finally, in 14 courses there is no assessment, which is unique to this cluster: outside this cluster all courses have assessment in one form or another. With respect to content, this cluster is mixed.

(5) *Upper left*. These 11 courses all originated from one author from one institution. Like the previous cluster, ICT is not used intensively and teaching occurs face-to-face. Half of these courses focus on learning a language, the other half focus on other discipline specific skills. The pedagogical approach is equally often collaborative as individual. The

courses are organised by a commercial party, have a small group size (11-20), exercises are done individually and assessments focus on knowledge.

(1) *Near upper right.* These 36 courses use ICT for various purposes but not for assessment, which is why they appear in the middle of dimension "1. ICT: less versus more". They are on the language-half of dimension "2. Mathematics versus language". However, these courses are not about language but about academic skills. Like most language courses teachers have designed their courses in an equal mix of collaborative and individual work using blended learning.

(4) *Far upper right*. These 10 courses use ICT for almost all possible purposes and teachers in these courses use ICT tools whose use is rare in other clusters. Half of these courses are language courses, the other half of the courses are other discipline specific skills. Teachers in this cluster use blended learning and their pedagogy is more often collaborative. Assessment focuses on skills. In half of these courses, a commercial party organises the course.

(6) *Lower right*. These 9 courses are from four teachers in one institution. These teachers use ICT for assessment as well as for collaboration, which places them on the right half of the ICT-dimension. The courses are on the mathematics half of dimension "2. Mathematics versus language", but the content is gamma sciences: they share with most mathematics courses the use of distance learning, exercises are done individually, and assessments focus on knowledge. A difference with the cluster 2 of mathematics courses is the emphasis on collaborative work.

(2) *Down*. These 22 courses are in large majority about mathematics. Most teachers in this cluster use distance learning, have flexible content adapted to the individual and use a self-directed learning approach. Furthermore, assistance and feedback is often provided by an online tool instead of a teacher, and the assessment focuses on knowledge. ICT is important for this group of courses but it is used for a limited number of purposes. Finally, the number of different ICT tools used is limited, making them earn a place in the middle of the ICT-dimension.

From the clustering it becomes obvious that there's some granularity in our data: sometimes courses share a design because they originate from one institution, or even from one author. Two such single-institution clusters were found (clusters 5 and 6). Finding such clusters was not our priority, but on the other hand, separating them off helped in giving the remaining clusters a clearer profile.

The same six clusters can also be pictured in the higher MCA-dimensions 3, 4 and 5. In Figure 3, the distinguishing variables for the dimension "3. Lower versus higher Bloom levels" are highlighted. Three of the six clusters are on the lower side of this dimension. Two of those three clusters are relatively close to the origin: their course designs contain more individual exercises and assessment focuses on knowledge rather than skills. The third cluster, being positioned further down on that same side, also has a small group size, content differentiated according to subgroups, and a commercial party organising the course.

Insert Figure 3 about here

In Figure 4 the distinguishing variables for the dimension "4. Gamma sciences versus others" are highlighted. One cluster of nine courses singles itself out on the gamma side of the scale: it has assessments that focus less often on skills. One other cluster singles itself out at the other side of the scale, but stays relatively close to the origin: it has assessments that focus more often on skills. The other four clusters have near-neutral positions on dimension 4. Finally, with regard to the dimension "5. very small courses versus others" we found that none of our six clusters singles itself out on either side of this dimension.

Insert Figure 4 about here

Evaluation results

As a third and last part of our multi-method approach, we conducted a content analysis on the open parts of the questionnaire. Content analysis of submitted course evaluations and various other text fields in our questionnaire indicates that authors of submitted course descriptions in large majority evaluated their courses positively, with only 9 out of 82 evaluations being negative (Table 4). The data and arguments mentioned to support these evaluations vary widely in kind and quality. The nine negative evaluations were unequally distributed over the six clusters of courses (Table 3): six of those nine negative evaluations occurred in cluster "3. Left", the cluster that had little or no ICT and often no assessment, while cluster "5. Upper left" has a higher than average number of positive evaluations.

Insert Table 3 about here

Cluster 5 is a small cluster, where all courses having been submitted by a single author, who consistently evaluated the submitted courses as positive. Cluster 3 is a large cluster with 30 courses from 13 countries and many different authors. For 18 of these courses evaluations are known: one third of these is negative, while two third is positive. From the other clusters (1, 2, 4, 5 and 6), none has more than one negative evaluation and this amounts to a maximum of 11% per cluster. As a conclusion we may state that all six clusters can be considered as “good” practices, however for courses in cluster 3 with some more reservations than for the other clusters.

Table 4 shows the correlations of course evaluation with each of the five dimensions as revealed by MCA. Two of the five dimensions correlate significantly with course evaluation. Evaluations are more often positive on the "language" side of dimension "2. Mathematics versus language" and on the "lower" side of dimension "3. Bloom levels: lower versus higher".

Insert Table 4 about here

These findings correspond with the high proportion of negative evaluations found in cluster "3. Left", because that cluster is wholly on the "academic" side of that dimension. Also, the fact that 14 of the 30 courses in this cluster have no assessment suggests why some of these transitional courses might be doing less well: it is likely that they ask too little commitment from their participants.

Discussion

The aim of this research was to address how teachers design and implement transitional courses using ICT and how teachers balance and integrate the various cognitive, pedagogical, social, organisational and technological course elements. In particular, we focused on distilling these course elements in 118 educational scenarios used for transitional courses using a multi-method approach. By means of a multiple correspondence analysis it is possible to answer the first research question. Five dimensions that together catch the main differences between transitional practices are identified and interpreted. Those dimensions are in decreasing importance: *1) ICT: less versus more; 2) Mathematics versus language; 3) Lower versus higher Bloom levels; 4) Gamma sciences versus others; and 5) Very small group size versus others*. Of all variation amongst the 68 variables included in the database, no less than 47% could be explained by just five dimensions, which is remarkable given the heterogeneity of courses, cognitive contents, pedagogical approaches, ICT usages and the fact that contributions came from 65 institutions from 22 countries.

Two of these dimensions (2 and 4) show strong relationships between content and pedagogical choice. Courses in mathematics are characterised with individualised work forms, individualised course content and distance learning. Courses teaching a specific language, on the contrary, are related to collaborative work forms, differentiated course content according to subgroup and face-to-face learning. As Crowe and Zand (2000) state, mathematics is inherently less verbal than other subjects and debate – and therefore collaboration – plays a lesser role in mathematic courses than in other domains. Language courses *in se* demand collaboration to a much greater extent than mathematics courses do, because speaking is an essential feature of learning a language. Two other dimensions show relations between organisational context and pedagogy (3 and 5). For example, in the fifth dimension there is a relationship between very small group size and a collaborative work form.

Dimension (1) summarises the strong correspondence amongst the majority of ICT related variables, and the lack of correspondence of most of these with other aspects of courses. In other words, ICT appears to be a pure factor in our multiple correspondence analysis, which implies that the choice on how to use ICT (purpose, choice of tools, intensity, etc.) in transitional education appears to be independent from other design decisions like pedagogical approach or cognitive content. This is our first and most important finding in this study. An explanation why ICT related variables show so little relationship with other type of variables is likely found in two supposed common causes: the teacher either love or hate ICT; and/or local circumstances provide (in)sufficient support for ICT. Nonetheless, the fact that most ICT related variables do not correspond with any of the content or pedagogical variables may be a cause of concern.

Mishra and Koehler (2006) argue that teachers should integrate their usage of technology when designing the cognitive content and pedagogy of the course. However, our findings indicate that in practice teachers will combine all different types of choices for an ICT tool with the choice for a particular content (e.g. mathematics, language), pedagogical choice and learning setting (i.e. face-to-face, blended, distance) when delivering a transitional course. In other words, in contrast to the argumentation of Mishra and Koehler (2006) and other researchers that teachers are implementing ICT in their education depending on affordances of the tool, we find that ICT usage is not significantly related to pedagogical approach and content of a course. At the same time it is equally possible that each teacher has a pedagogical reasoning for using a certain ICT tool for a certain course. However, if this is the case, then the results of the course and ICT design implementations by teachers show little common patterns yet. In other words, there is little consensus on what tool to use in a given context. ICT-use now seems largely a matter of individual or institutional preference. If ICT continues to integrate with other aspects of education, then we expect the reasons for ICT-variables to correlate among each other to become less (less love/hate feelings, good support everywhere). At the same time, we expect the correlations of the ICT-variables with content and pedagogical variables to increase (indicating growing consensus about using tool

X in context Y). As a conclusion, the disappearance of a single "ICT"-dimension should probably be taken as a sign of growing integration of ICT.

The six clusters found in the two-step clustering technique provide an answer to the second research question. These clusters show often-occurring combinations of content, educational decisions, use of ICT, and institutional context. Each cluster is to be regarded as a tested combination of design decisions, for given content and context. This is our second important finding. Teachers in different countries seem to design and implement fairly similar course designs when content, context and pedagogical approach are given.

With this study we intended to address how teachers design and implement online and blended courses and how they combine content, context, organisation, pedagogical approach, assessment, ICT usage. Future research should address an in-depth qualitative approach to identify the success- and fail factors within each of the six clusters. For example, by using focus group discussions with the teachers within and across the six clusters, underlying design principles not included in our method can be uncovered. Finally, the validation of our descriptive framework needs to be addressed. The fact that the low-dimensional model consisting of only five dimensions is able to explain 47% of the total variation of the 68 variables specifying the 118 educational scenarios indicates that our framework provides an adequate description of the main characteristics of relevant educational options. Furthermore, given that our dataset includes respondents from 65 institutes from 22 countries, this increases the validity of our findings that teachers design fairly similar courses when the topic and pedagogical approach are known without specifically linking it to the possibilities, purposes or affordances of ICT. Finally, the absorption of all ICT-related factors in one dimension that is independent of all non-ICT related factors also implies that design decision with regards to pedagogical approach, organisation, assessment, and so on appear to be stable constructs. In other words: both within a paper and pencil context, and a high-tech context, similar design decision are taken by teachers offering transitional courses. Overall, our study contributed to the debate how teachers design and implement effective interactive learning environments, whereby the specific discipline (mathematics, social science, language) and pedagogical approach (collaborative, self-directed) seem to influence how teachers embed ICT tools in their education.

Acknowledgments

The authors would like to thank the EU LLP KA3 ICT funding the S.T.E.P. project (http://www.transitionalstep.eu/), which enabled this research project. This publication reflects the views only of the authors, and the European Commission cannot be held responsible for any use which may be made of the information contained therein. We would like to thank the two anonymous reviewers for their suggestions of improvement of this article.

References

Attewell, P., Lavin, D., Domina, T., & Levey, T. (2006). New Evidence on College Remediation. *The Journal of Higher Education, 77*(5), 886-924.

Bettinger, E. P., & Long, B. T. (2005). Remediation at the community college: Student participation and outcomes. *New Directions for Community Colleges, 2005*(129), 17-26.

Bloom, B. S., Englehart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: Handbook I: Cognitive domain*. New York: David McKay.

Boyer, P., Butner, B., & Smith, D. (2007). A portrait of remedial instruction: faculty workload and assessment techniques. *Higher Education, 54*(4), 605-613.

Brants, L., & Struyven, K. (2009). Literature Review on Online Remedial Education: A European Perspective. *Industry and Higher Education, 23*(4), 269-276.

Brouwer, N., Ekimova, L., Jasinska, M., Van Gastel, L., & Virgailaite-Meckauskaite, E. (2009). Enhancing mathematics by online assessments, two cases of remedial education considered. *Industry and Higher Education, 23*(4), 277-284.

Bryant, S., Khale, J., & Schafer, B. (2005). Distance Education: A Review of the Contemporary Literature. *Issues in Accounting Education, 20*(3), 255-272.

Conley, D. T. (2007). The Challenge of College Readiness. *Educational Leadership, 64*(7), 23-29.

Crowe, D., & Zand, H. (2000). Computers and undergraduate mathematics: I: setting the scene. *Computers & Education, 35*(2), 95-121.

De Laat, M., Lally, V., Lipponen, L., & Simons, R.-J. (2007). Online teaching in networked learning communities: A multi-method approach to studying the role of the teacher. *Instructional Science, 35*(3), 257-286.

EARLI. (2009a). Earli Association News. *Educational Research Review, 4*(1), I-V.

EARLI. (2009b). Earli Association News. *Educational Research Review, 4*(2), I-III.

EUROSTAT. (s.d.). *Mobility of students in Europe.* Retrieved from http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,39140985&_dad=portal&_schema=PORTAL&screen=detailref&language=en&product=REF_TB_education_training&root=REF_TB_education_training/t_edtr/t_educ_indic/tps00064.

Garrison, D., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education *The Internet and Higher Education, 2*(2), 87-105.

Hurme, T., Palonen, T., & Järvelä, S. (2007). Metacognition in joint discussions: an analysis of the patterns of interaction and the metacognitive content of the networked discussions in mathematics. *Metacognition and Learning, 1*(2), 181-200.

Järvelä, S., & Häkkinen, P. (2002). Web-based Cases in Teaching and Learning – the Quality of Discussions and a Stage of Perspective Taking in Asynchronous Communication *Interactive Learning Environments, 10*(1), 1-22.

Järvelä, S., Järvenoja, H., & Veermans, M. (2008). Understanding the dynamics of motivation in socially shared learning. *International Journal of Educational Research, 47*(2), 122-135.

Jindal-Snape, D. (2010). *Educational transitions: Moving Stories from Around the World*: Routledge.

Jonassen, D. H., & Kwon, H. (2001). Communication patterns in computer mediated versus face-to-face group problem solving. *Educational Technology Research and Development, 49*(1), 35-51.

Kirschner, P. A., Strijbos, J.-W., Kreijns, K., & Beers, P. (2004). Designing electronic collaborative learning environments. *Educational Technology Research and Development, 52*(3), 47-66.

Koehler, M. J., & Mishra, P. (2005). Teachers learning technology by design. *Journal of Computing in Teacher Education, 21*(3), 94-102.

Kozeracki, C. (2002). Issues in Developmental Education. *Community College Review, 29*(4), 83-100.

Löfström, E., & Nevgi, A. (2008). University teaching staffs' pedagogical awareness displayed through ICT-facilitated teaching. *Interactive Learning Environments, 16*(2), 101-116.

Lou, Y., Bernard, R., & Abrami, P. (2006). Media and Pedagogy in Undergraduate Distance Education: A Theory-Based Meta-Analysis of Empirical Literature. *Educational Technology Research and Development, 54*(2), 141-176.

Mazzolini, M., & Maddison, S. (2003). Sage, guide or ghost? The effect of instructor intervention on student participation in online discussion forums. *Computers & Education, 40*(3), 237-253.

McCabe, R. H., & Day, P. R. (1998). What works in development education. In R. H. McCabe & P. R. Day (Eds.), *Developmental education: A twenty-first century social and economic imperative.* (pp. 19-26). Mission Viejo, CA: League for Innovation in the Community College.

Merisotis, J. P., & Phipps, R. A. (2000). Remedial Education in Colleges and Universities: What's Really Going On? *The Review of Higher Education, 24*(67-85).

Michailidis, G., & De Leeuw, J. (1998). The Gifi System of Descriptive Multivariate Analysis. *Statistical Science, 13*(4), 307-336.

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record, 108*(6), 1017-1054.

Resta, P., & Laferrière, T. (2007). Technology in Support of Collaborative Learning. *Educational Psychology Review, 19*(1), 65-83.

Rienties, B., Grohnert, T., Kommers, P., Niemantsverdriet, S., & Nijhuis, J. (2011). Academic and social integration of international and local students at five business schools, a cross-institutional comparison. In P. Van den Bossche, W. H. Gijselaers & R. G. Milter (Eds.), *Building Learning Experiences in a Changing World* (Vol. 3, pp. 121-137). The Netherlands: Springer Netherlands.

Rienties, B., & Tempelaar, D. T. (2009). Mobility of lifelong learners and IT: Introduction to Special Issue. *Industry and Higher Education, 23*(4), 265-268.

Rienties, B., Tempelaar, D. T., Dijkstra, J., Rehm, M., & Gijselaers, W. H. (2008). Longitudinal study of online remedial education effects. In N. P. Barsky, M. Clements, J. Ravn & K. Smith (Eds.), *Advances in Business Education and Training 1: The Power of Technology for Learning* (pp. 43-59). Dordrecht: Springer.

Rienties, B., Tempelaar, D. T., Van den Bossche, P., Gijselaers, W. H., & Segers, M. (2009). The role of academic motivation in Computer-Supported Collaborative Learning. *Computers in Human Behavior, 25*(6), 1195-1206.

Rienties, B., Tempelaar, D. T., Waterval, D., Rehm, M., & Gijselaers, W. H. (2006). Remedial online teaching on a summer course. *Industry and Higher Education, 20*(5), 327-336.

Roueche, J., & Roueche, S. (1999). *High stakes, high performance: making remedial education work*. Washington DC: Community College Press.

Schellens, T., Van Keer, H., De Wever, B., & Valcke, M. (2009). Tagging thinking types in asynchronous discussion groups: effects on critical thinking. *Interactive Learning Environments, 17*(1), 77-94.

Tempelaar, D. T., Rienties, B., & Giesbers, B. (2009). Who profits most from blended learning? *Industry and Higher Education, 23*(4), 285-292.

Van der Wende, M. C. (2003). Globalisation and Access to Higher Education. *Journal of Studies in International Education, 7*(2), 193-206.

Wang, Q. (2009). Designing a web-based constructivist learning environment. *Interactive Learning Environments, 17*(1), 1 - 13.

Wheeler, S. (2007). The influence of communication technologies and approaches to study on transactional distance in blended learning. *ALT-J, 15*, 103-117.

Wieland, A., Brouwer, N., Kaper, W., Heck, A., Tempelaar, D. T., Rienties, B., et al. (2007). Factoren die een rol spelen bij de ontwikkeling van remediërend onderwijs. *Tijdschrift voor Hoger Onderwijs, 1*, 2-15.

Table 1. Purpose of ICT usage in face-to-face, blended and distance education.

ICT usage in course (in %)	Face-to-Face (n=46)	Blended (n=47)	Distance (n=26)	Chi-Square
ICT for Storage	43.5	72.3	84.6	14.599**
ICT for Communication	41.3	83.0	73.1	18.700**
ICT for Collaboration	30.4	59.6	50.0	8.133*
ICT for Websearches	28.3	68.1	46.2	14.815**
ICT for Presentations	26.1	38.3	19.2	3.331
ICT for Submitting	23.9	68.1	61.5	20.048**
ICT for Webimages	19.6	46.8	34.6	7.747*
ICT for Feedback after tests	17.4	46.8	76.9	24.896**
ICT for Assessment	13.0	40.4	80.8	32.233**
ICT for Tests	8.7	36.2	57.7	20.189**
ICT for Simulations	6.5	21.3	38.5	11.057**
ICT for Other	4.3	8.5	7.7	0.692
Total ICT purposes	2.6 (3.0)	5.8 (3.0)	6.3 (2.6)	61.384**

** Pearson Chi-Square 2-sided significant at 0.01

* Pearson Chi-Square 2-sided significant at 0.05

Table 2. Sizes and names for the six clusters found.

Cluster	N	% of Total	Countries	Remarks
1. near upper right	36	30.50	11	
2. downward peninsula	22	18.60	6	
3. left	30	25.40	13	
4. far upper right archipel	10	8.50	5	
5. upper left island	11	9.30	1	1 institution, 1 author
6. lower right two islands	9	7.60	1	1 institution, 4 authors

Table 3. Correlation of evaluation with cluster membership as a yes/no variable.

Cluster	Unknown	Positive	Moderately Positive	Moderatly negative	Negative	Total	Spearman Correlation coefficient
1. near upper right	15	14	6	1	0	36	-0.15
2. downward peninsula	4	9	9	0	0	22	-0.01
3. left	12	4	8	5	1	30	0.40**
4. far upper right archipel	4	2	3	1	0	10	0.12
5. upper left island	0	11	0	0	0	11	-0.35**
6. lower right two islands	1	5	2	0	1	9	-0.03
Total	36	45	28	7	2	118	

** Significant, P < 0.01 (2-tailed).

Table 4. Positive evaluation as a function of the five dimensions.

Dimension	Spearman Correlation	Direction of effect: more positive on
1. ICT, less -- more	0.09	
2. Mathematics -- language	0.23*	"language" side
3. Bloom level: no nonsense -- academic	0.38**	"no nonsense" side
4. Gamma sciences versus others	-0.05	
5. Group sizes: very small versus others	0.20	("others")

** Significant, P < 0.01 (2-tailed).

*Significant, P < 0.05 (2-tailed).

Figure 1. 118 courses plotted in MCA dimensions 1 and 2 (labelled by cluster).

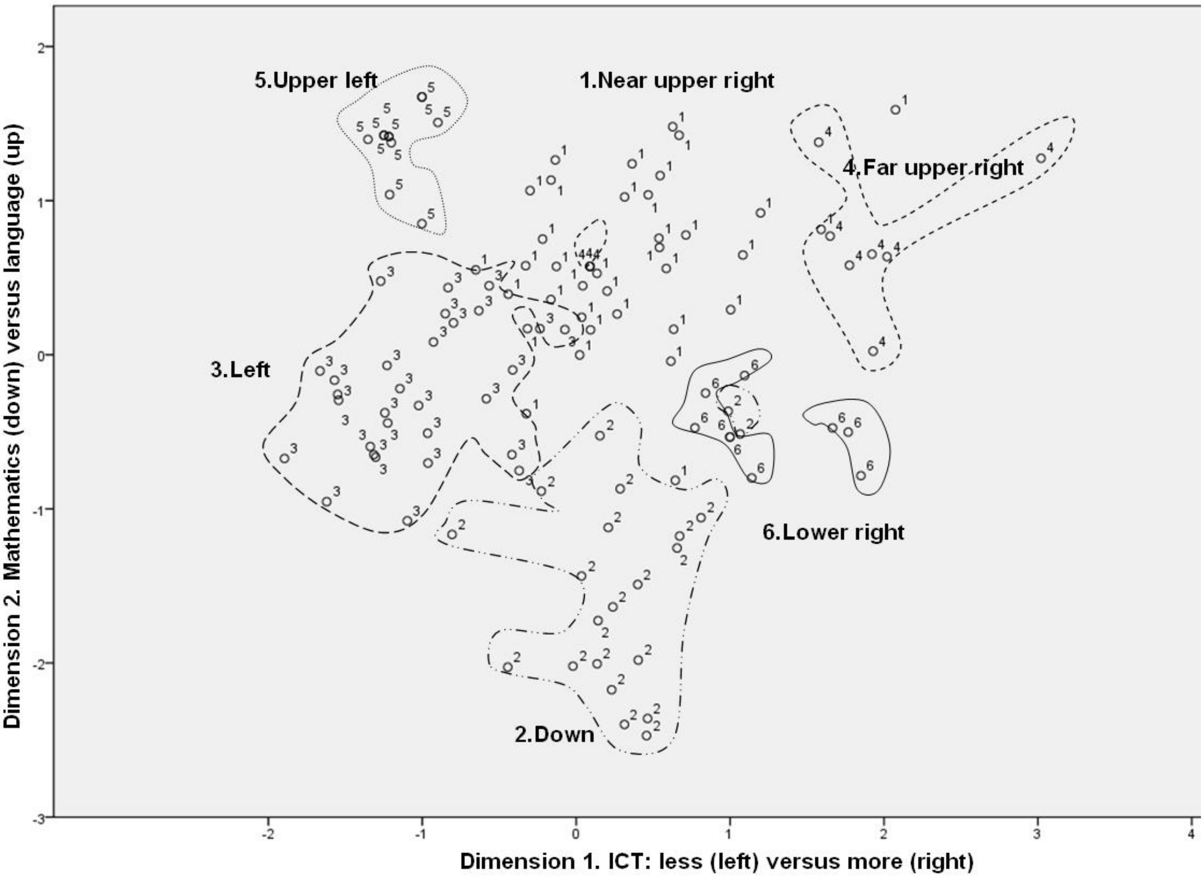


Figure 2. All clusters pictured in MCA dimensions 1 and 2 (properties relevant to other dimensions are greyed out).

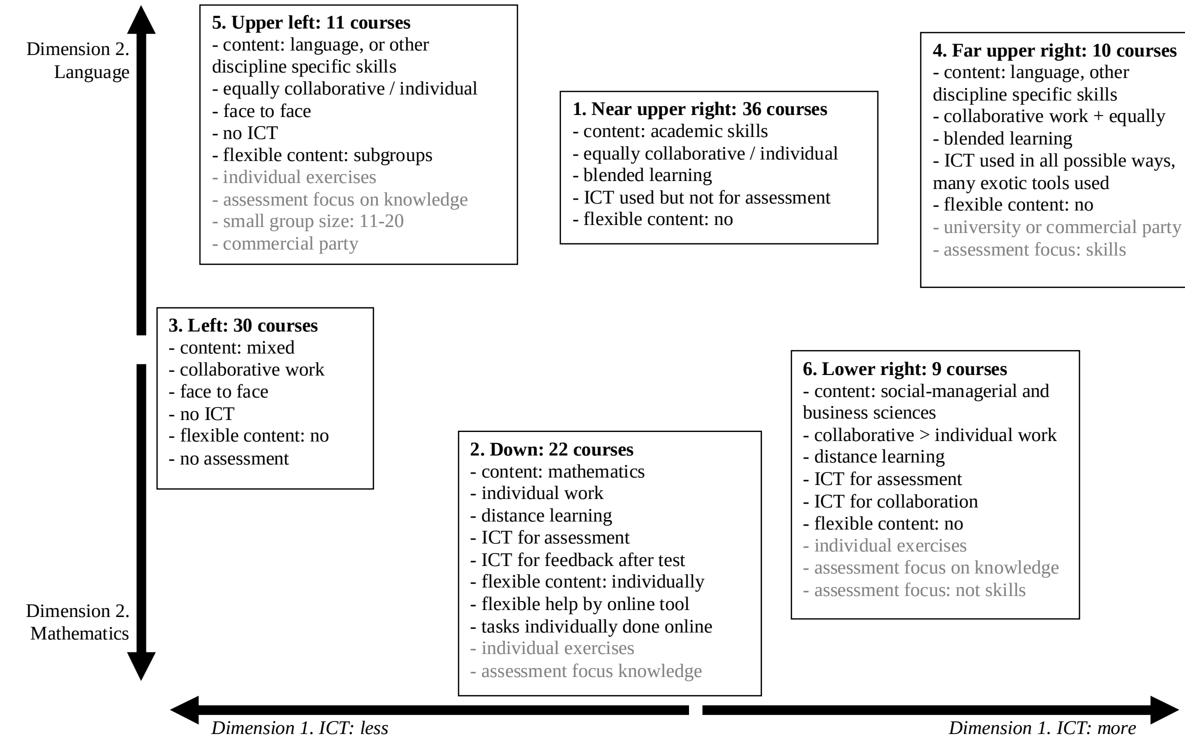


Figure 3. Clusters properties pictured in MCA dimensions 2 and 3.

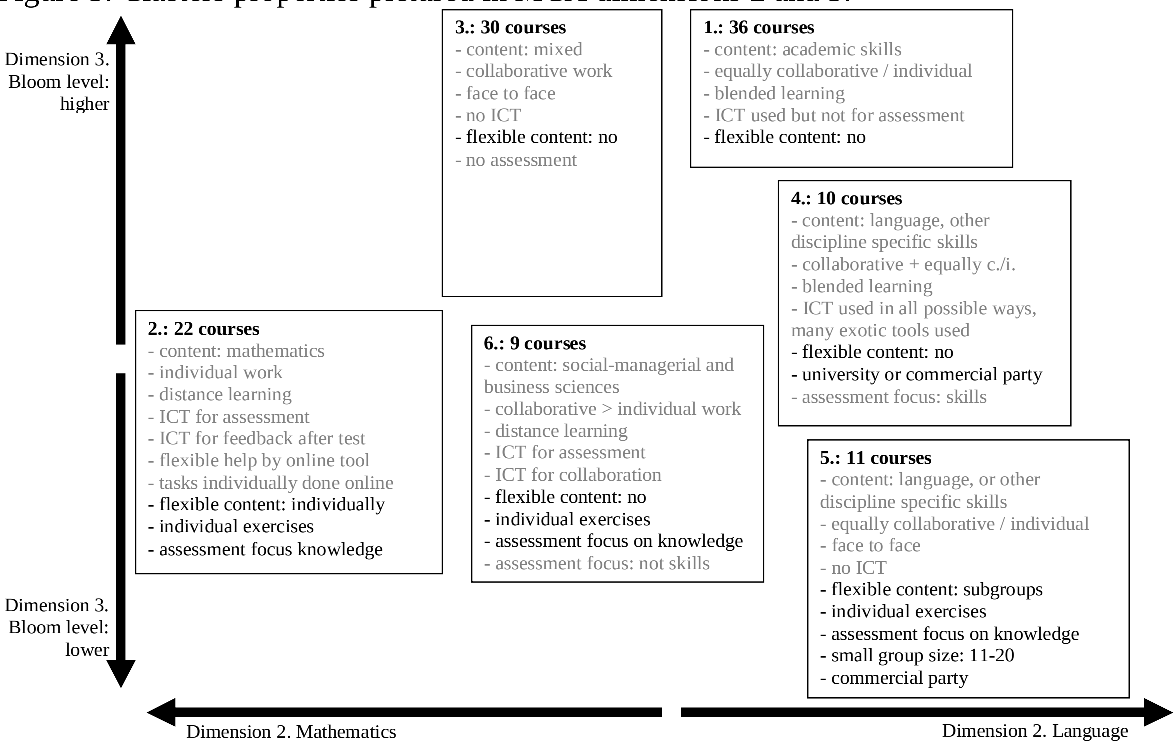
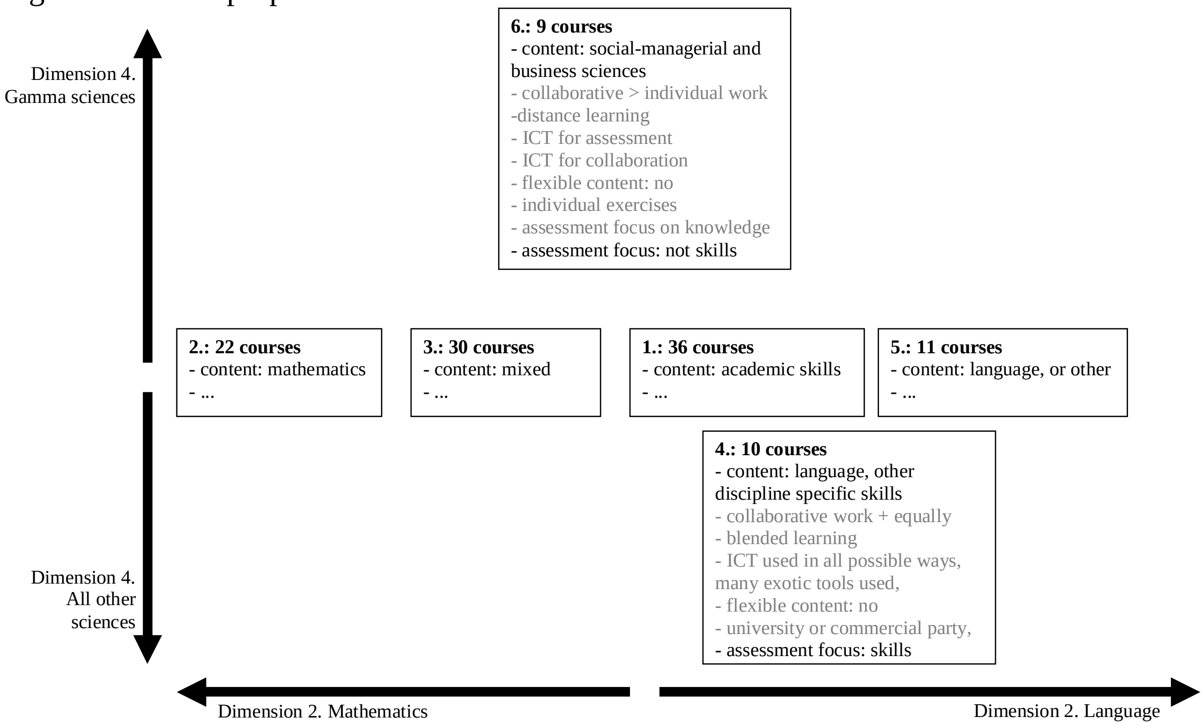


Figure 4. Cluster properties shown in MCA dimensions 2 and 4.



---

[i] EARLI stands for European Association for Research on Learning and Instruction, while EDINEB stands for EDucational Innovation in Economics and Business network

[ii] The complete descriptions of these courses including evaluation data can be found at http://www.XX.eu/