

D22 Analysis of Pilot

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Continuing/Higher Education in Research Methods Using Games

CHERMUG

Project Deliverable Report

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Executive Summary

The evaluation of the CHERMUG games was carried out in 3 phases which contributed in different ways to the game development and evaluation. Different cohorts of staff and students were involved in each phase and a detailed account of the list of pilot institutions is shown in Deliverable 21.

- Phase 1 was the preliminary testing of the initial game prototype and involved a small number of serious games experts, research methods experts and teacher trainers. Elements of the games were still changeable at this point.
- Phase 2 was the usability phase and involved nursing and social science staff involved in teaching research methods and students taking research methods modules. Surface elements of the games and game mechanics were still changeable at this point.
- Phase 3 of the evaluation was a more rigorous evaluation designed to establish whether the use of the CHERMUG games engages students and helps them to learn about research methods and statistics.

Much of the feedback in phase 1 concerned surface issues, such as the functionality of the game or the game mechanisms not working at all or as well as they should have. There were also requests for more clarification about what was to be done.

Phase 2 involved a larger scale questionnaire study with students to assess the broader usability, value and acceptability issues. Students generally agreed that the games were easy to use and understand and that they could help them in learning about research methods and statistics. There were interesting differences between students at the partners' universities in liking of the games with the vast majority of Romanian students really liking the games. The Scottish students were less overtly enthusiastic but still the majority found the games usable and useful. The Finnish students were much less impressed by the games but this might be attributable to the fact that the games were still in English and had not yet been translated into Finnish. There was also an interesting, maybe cultural, difference in acceptance of the quantitative and qualitative games with the Scottish students preferring the quantitative games over the qualitative while the Finnish and Romanian students preferred the qualitative games.

The phase 3 evaluation compared the use of the games with exercises with identical contents (both digital and paper-based), Thirteen different cohorts (varying in domain of study, level or type of student) with over 400 students in the partners sites in the UK, Romania and the Netherlands participated distributed over one of the conditions. Differences were identified between and in the cohorts tested such as perceived competence gain, motivation, usefulness or 'more of this', however, they were cohort or learner characteristic dependent. Overall, it found that following both the games and the exercises, students claimed that they were more interested in and enjoyed research methods more and found it less boring.



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Deliverable 22: Analysis of pilot

1. General introduction to the evaluation

The original project proposal stated that:

“the large scale pilot will be designed for at least 20 Higher Education and vocational training institutions across a minimum of 6 countries in Europe.”

While the original project proposal suggested that 20 institutions would be involved in piloting, it was decided at the second partners' meeting in Madrid that it would be more useful to involve 20 cohorts of students from partners' universities as this would ensure that the project partners would retain more control over the piloting which would hopefully lead to better data. It was felt that staff from partners' institutions would be more likely to take part and to incorporate the games into their teaching in a sensible way. It is widely acknowledged that the implementation of interventions can be quite variable depending on how the intervention is implemented and the staff who take part in the intervention /implementation (Woolfson, 2011). All university partners (UWS, UCM, OUNL, SAMK and UMFCV) agreed to take part in the pilots and provide different kinds of student groups with different approaches to and needs from research methods and statistics modules.

The project coordinator contacted the EACEA to confirm this change and it was agreed that we should run the pilot with 20 cohorts from the partners' institutions. Deliverable 21 shows the list of agreed pilot cohorts from the different partners at the different stages of the evaluation.

1.1 Design tasks

The evaluation of the CHERMUG games was seen as continuous with the design and development of the games. The two design tasks, the Cognitive Task Analysis and User Requirements Analysis, can be regarded as a kind of formative evaluation, addressing the feasibility and value of developing games to support research methods and statistics. These tasks are reported fully elsewhere (Deliverables 13 and 14) but to summarise that the User Requirements Analysis concluded that both staff and students were very receptive towards the idea of a game-based approach to teaching/learning research methods and statistics and the cognitive task analysis interviews with experts carried out for provided a clear overview of the processes required in developing an understanding of research methods and statistics and identifying the main problems and difficulties that students encounter in doing this.

1.2 Game development

At the start of the game development several individuals contributed ideas and materials to the development of the game, providing valuable advice especially about the sequencing of activities. They also suggested various teaching and research tools for research methods, such as the decision trees used in selecting statistical tests (see Figure 1). One member of nursing staff provided a board-game style format which she used with students for appraising qualitative papers. The game included “squares” for the different sections of a paper: the title, abstract, introduction, literature review, research hypotheses, aims/ objectives or research question/s, research design and methodology, sample, ethical issues and access, data collection, analysis and results, discussion, conclusions and recommendations. A set of questions was also provided such as “What were the main challenges to the researcher/s?” and “What are the potential benefits of this type of study?” Players had to navigate their way around the board as they read a specific research paper, making comments about and answering questions about the different sections of the paper. This “game” highlighted the importance for students of gaining a clear understanding that each paper (or research project) has a similar structure where the same issues need to be considered, i. e. the research methods cycle. This idea was important in designing the CHERMUG games.



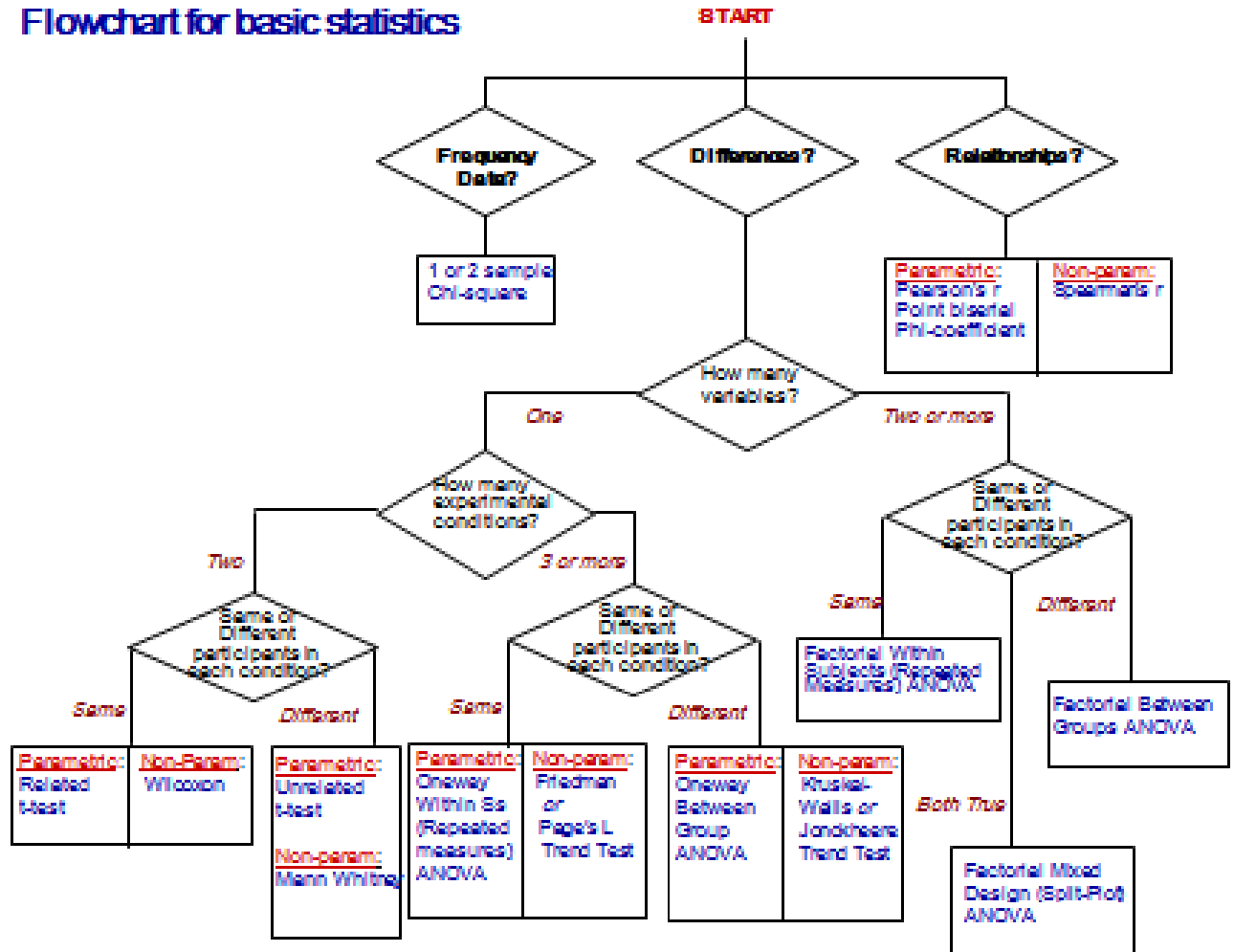
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Figure 1: Decision flowchart for basic statistical tests

Flowchart for basic statistics

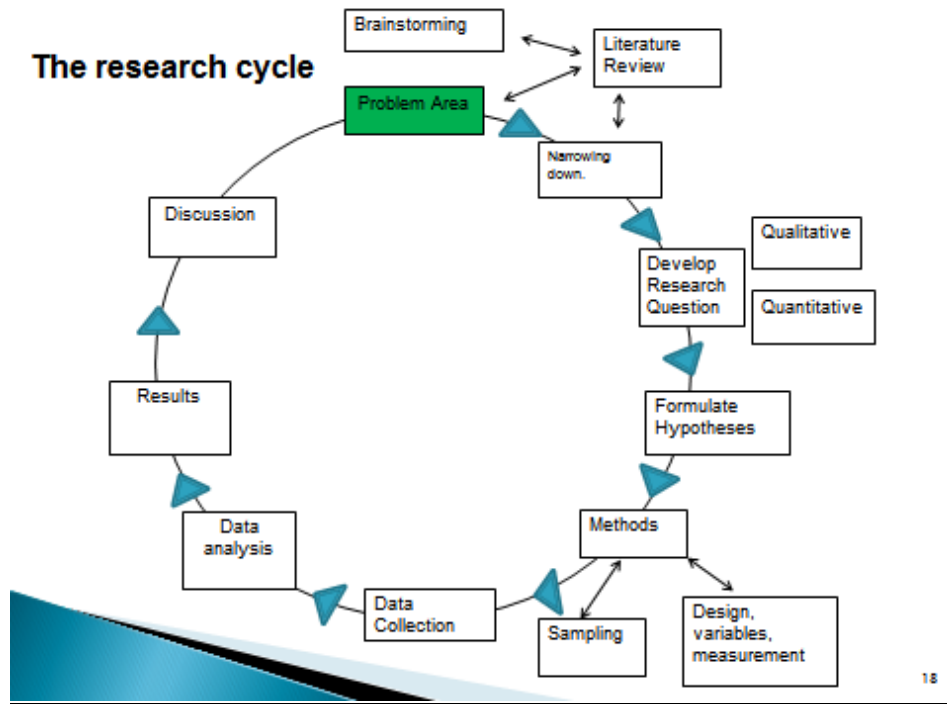


Adapted from Green, J. & O'Quinn, M. (1998). Learning to use the Chi-Square Test in psychology. Buckingham, UK: Open University Press.

The research cycle is clearly central to understanding research methods. Initially the project partners used van Buuren's (2008) model of the research methods cycle which proposed 4 quadrants (research question, data collection, data analysis, discussion and conclusion) but closer consideration of the early stages of the cycle by the partners indicated that many key decisions need to be tackled in the first quadrant. This led to the development of a more detailed model of the research cycle (see Figure 2) that was used in designing the sequence of activities for the quantitative game. It seems likely that the need to consider and coordinate all this information is a key reason why beginners find research methods difficult.



Figure 2: model of the research methods cycle



1.3 The CHERMUG games

11 CHERMUG games were developed as shown in table 1. There were 8 quantitative games and 3 qualitative games. All the games focussed on the topic of obesity and related issues due to the relevance and interest in these topics. Of the 8 quantitative games, 5 concerned chi square analysis, and 3 concerned the independent samples t-test. Each of the quantitative games was named according to the variables involved in that game. At this stage of the evaluation, there was still the opportunity to change some of the game features.

Table 1. The Quantitative and Qualitative CHERMUG Games

Name of Quantitative Game		Name of Qualitative Game	
QUANTITATIVE	Gender and Reward	QUALITATIVE	Level 1: Differences between the Qualitative and Quantitative Approaches.
	Skipping Meals and Obesity		Level2: Study Design and Coding
	Nationality and Mediterranean Foods		Level 3: Study Design and Coding
	Type of Diet and Weight Loss		
	Media Consumption and Obesity		
	Exercise Program and Drop-out		
	Nationality and Body Image		
	Gender and Protein		



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1.4 The evaluation of the games

The aim of Work Package 5 was to perform a large-scale pilot of the CHERMUG games with nursing and social science students and their lecturers across many European countries. The objective of Deliverable 22 is to conduct an analysis of the large-scale pilot with the aim of obtaining student feedback about the usability and usefulness of the 11 developed CHERMUG games, the value of the games in supporting learning of qualitative and quantitative research methods, and their perceptions of them and the game activities.

The evaluation of the CHERMUG games was carried out in 3 phases which contributed in different ways to the game development and evaluation.

- Phase 1 was the preliminary testing of the initial game prototype and involved a small number of serious games experts, research methods experts and teacher trainers. Elements of the games were still changeable at this point.
- Phase 2 was the usability phase and involved nursing and social science staff involved in teaching research methods and students taking research methods modules. Surface elements of the games and game mechanics were still changeable at this point.
- Phase 3 of the evaluation was a more rigorous evaluation designed to establish whether the use of the CHERMUG games engages students and helps them to learn about research methods and statistics.

Overall, 26 cohorts with 1034 players took part in the piloting: 3 cohorts of staff (N=13) and 3 student cohorts (N=21) took part in phase 1, 7 student cohorts took part in phase 2 (N=590) and 13 student cohorts took part in phase 3 (N=400) (see table 2). Further details of the cohorts who took part in the different phases are shown in Deliverable 21 and below.

Table 2. Numbers of Cohorts and participants involved in phases 1, 2 and 3 of the evaluation

Phase	Cohort Numbers	Participant Numbers
phase 1	6: 3 staff and 3 student	44: 13 staff plus 21 students
phase 2	7	590
phase 3	13	400
Total	26	1034



2. Phase 1: Staff and student views of the initial prototypes of the CHERMUG games

2.1 Background

Phase 1 of the evaluation involved preliminary testing of players' reactions to the first working prototypes of the games to establish what potential players of the games thought about the game content and design, decisions about game mechanics, interactions and game mechanisms, the supporting narrative, the way in which the game had been implemented and players' views of whether the games supported learning about research methods and statistics.

In addition it was important to ensure that the game mechanisms worked in the ways that were intended. Suggestions for improvements were also sought. It was still possible to modify some higher level elements of the games at this point. The most recent version of the games were used at all stages. Data collected at this stage comprised mainly qualitative comments from players as they played the games.

2.1.1 Materials

All 11 CHERMUG games were piloted in phase 1 although some participants only played the quantitative games and some only played the qualitative games. At this stage of the evaluation, there was still the opportunity to change some of the game features.

2.1.2 Participants: Staff

PLAYGEN developed the quantitative games (PLAYGEN) and UCM developed the qualitative games and feedback at this stage was provided by the other partners (see table 3). A total of 13 serious games experts, research methods experts and teacher trainers from 3 partners (OUNL, UWS and SAMK) were involved in this stage as shown below. All phase 1 piloting took place with the English versions of the games.

Table 3. The List of Cohorts for the Staff Evaluation in Phase 1

cohort	discipline	Games	date	Number
UWS: 1 expert in teaching quantitative methods; 2 experts in teaching qualitative research methods;	psychology, computing science, social policy	qualitative and quantitative games English version	20/11/2012 19/03/2013	3
SAMK: 3 lecturers in nursing provided qualitative feedback about both qualitative and quantitative games	nursing	qualitative and quantitative games English version	26/03/2013	3
OUNL: 7 Serious game experts in Learning Sciences	Learning Sciences	qualitative and quantitative games English version		7
Total				13

2.2 UWS cohort

2.2.1 UWS staff participant 1: feedback about quantitative games

1 expert in teaching quantitative research methods (one Psychology lecturer) provided qualitative feedback about a very early version (20/11/2012) of the quantitative games.

2.2.2 Results

The participant's comments focused largely on which activities were required in the game and the proposed sequencing of the activities. Required activities concerned the design of the study, asking



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whether the study looked at correlations between conditions or differences between conditions. Was one counting categories? The identification of variables and measurement of variables was important too and related to the design of the study. This participant suggested that it would be useful to base some of the decisions made in the game on the decision trees used in selecting statistical tests (see figure 1).

This participant also argued that it would be useful to structure students' interactions carefully if we want them to be maximally effective. One way in which this can be accomplished is by getting students to predict the results of an operation before interacting with it. Possible activities included getting players to make predictions.

2.2.3 Conclusion

The feedback from this participant helped in developing the sequencing of the activities and decisions in the quantitative games.

2.2.4 UWS staff participants 2 and 3: feedback about qualitative games

2 experts in teaching qualitative research methods (one Social Policy lecturer; one research associate in Computing) played an early version (19/03/2013) of the 3 levels of the qualitative games and provided qualitative feedback about these.

2.2.5 Results

General comments about the CHERMUG qualitative and quantitative games were as follows:

General: Both experts felt that all 3 qualitative games were quite hard to follow and required more instructions. This was also true for the introductory slides which described the obesity epidemic in Europe which needed additional explanations, stating the source and the date when the data on adult obesity in Europe was collected.

Both experts provided feedback about surface features of the games which they did not like such as the lack of an arrow to guide players through the game.

Level 1: Both experts also felt that additional instructions were required for the level 1 game, to explain that it is a drag and drop game.

The designers wanted the experts' opinions about whether to include ambiguous and difficult examples in the level 1 drag and drop games. The experts felt it was better to include some of the more difficult/ambiguous examples and the tutor should flag this up to students in debriefing outside the game. One expert said that she found the drag and drop game difficult but she quickly got most of it right.

Levels 2 and 3: Both experts also found that the level 2 and 3 games required further instructions to explain that you are going to look at the method used, the place where data would be collected and how many participants were required.

The 2 experts disagreed about the value of the qualitative data coding game. One expert liked it and the other did not. She provided useful feedback about why she didn't like it saying that *"the data excerpts are too long and several would be better shortened as they could come under a number of themes/categories. In her qualitative coding exercises these (the extracts) would be too long to be a piece of data; you would want smaller segments. At the moment you can put each data extract into more than one category – is this intentional? Are these marked wrong?"*

She also found the qualitative coding exercise a bit clunky and not a very subtle way of doing coding! Not intuitive. (Disappointing!). She said that you would normally do the analysis the other way around.



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You would normally start with the data and you would not have the thematic categories and would get the students to make up the categories. You would need to make it clear in your instructions to students that someone has already analysed the data and these are the thematic categories that they came up with.

Despite these reservations the expert could see that she might use the game as a Moodle exercise on its own if it were “smoothed out and finessed” and she said that she might possibly use it in seminars.

The other qualitative expert liked the data coding games. He “got” the fact that it was the wrong way round but felt that it would provide useful practice for novices in qualitative coding which would help them to see the link between the data and the categories.

In the light of the experts’ feedback, some changes were made to the qualitative games, mainly including more explanations and ensuring that the game mechanics worked properly.

2.2.6

Conclusion

The feedback from these participants indicated that there was too much text to read and too few instructions and this was modified in the next version of the games. In addition the game mechanisms for the qualitative coding games were improved in subsequent versions.

2.3 SAMK cohort

2.3.1 Participants

3 lecturers in nursing provided qualitative feedback about the next iteration of the qualitative games and quantitative games.

2.3.2 Results

Likes

The SAMK nursing lecturers liked

“Hypothesis formation and interpretation of the exercises were good. The feedback confirmed the learning process.”

Drag and drop was “good way to check the student’s level of understanding”

Suggestions for improvement

“At the end of the summary it would be good to have a comparison with the other players and also to show my score against the maximum attainable.”

One SAMK participant thought that the link between the introduction to the topic of obesity and the drag and drop exercise which illustrated differences between qualitative and quantitative approaches was not clear and needed to be made clearer.

Other comments concerned the operation of the drag and drop mechanism which didn’t seem to work properly (showed red in both boxes when it should have been green in one).

2.3.3 Conclusion

The feedback from these participants mainly concerned the operation of different parts of the games and these were improved in subsequent versions of the games. For example participants indicated that there was too much text to read and too few instructions and this was modified in the next version of the games.



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2.4 OUNL cohort (04 04 2013)

2.4.1 Participants

5 Serious game experts in Learning Sciences (1 PhD, 1 Postdoc, 3 Senior Researchers) were introduced to the CHERMUG games and given hands-on experience of (part 1) qualitative games (part 2) quantitative games. They completed usability questionnaires and provided verbal feedback about the games in discussion.

1 Research Methods Section Head (Senior Researcher) took part in a slightly different sequence of activities: Session 1: CHERMUG introduction + Qualitative games + usability questionnaire & issues reporting + discussion; Session 2: Quantitative games + usability questionnaire & issues reporting + discussion.

1 teacher training specialist (Senior Researcher) also took part: CHERMUG introduction + Qualitative games + usability questionnaire & issues reporting + discussion; Session 2 Online: Quantitative games.

Details of participants are shown in table 4.

Table 4: OUNL participants

Cohort	Subject Discipline	Place of Data Collection	Date of Data Collection	Played		
				Qualitative games	Quantitative games	
1. Serious game experts (1 PhD, 1 Postdoc, 3 Senior Researchers)	Learning Sciences	Lab	8-4-2013	x	x	5
2. Research Methods Section Head (Senior Researcher)	Psychology	Lab	2-5-2013 & 3-5-2013	x	x	1
3. Teacher Trainer	Learning Sciences	Lab & Online	7-5-2013	x	x	1
TOTALS						7

2.4.2 Results

General comments about the CHERMUG qualitative and quantitative games were as follows:

Positive feedback

Feedback at this stage was generally positive. Positive comments were that the content was good, there was an easy introduction and the repetition is good. Overall the material was quite interesting and it supports practice of skills. The games are a good way to teach statistics. They are interactive and the cases are realistic.

Some comments centred on whether it really was a game. "It is more a multimedia exercise as a game."

Suggestions for modification

Games structure

The structure of the game was a bit old-fashioned (although this was not necessarily regarded as negative).



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Rewards

The reward system was viewed as a bit childish. The rewards are not content related.

Role in learning

One interviewee questioned where the games fit in the learning process. There was a feeling that the game rehearses material rather than helps you to learn. They felt that instruction was really required, and learning should be more up-front.

Where is the learning?

The added value of the game is not always clear: maybe more fun to do it this way instead of in a book?

Feedback

Including more help information and hint messages would help to inform players about the reasons for their mistakes and provide effective feedback. Some students might simply try to guess the answers. In addition, people might be able to guess the answers if all the same types of game are organized together in a row.

The feedback mechanism is not elaborated well enough. It might be useful to incorporate more hints into the game rather than providing feedback messages to give more insights into what is asked (not necessarily 100% related to the answers). For instance in the hangman example where the answer is nominal, it is not clear that this is what is being asked.

Differences between the games

With respect to the differences between the games, the quantitative games (Playgen) require players to formulate the hypothesis whereas in the qualitative games (UCM) players are presented with the research questions. This interviewee felt that the first mechanism is better.

Content

More variability in case content would be interesting

Navigation

Navigation only forward no way back (it is annoying not be able to go back)

Terminology

Terminology is not always clear for beginners. It would be useful to include more hints such as: if terminology is unknown to you, please consult "xxxxx".

Additional support materials

It was felt that teacher guidelines were required to assure a proper use. Since the game is more about rehearsal, repetition and testing than about instruction, I assume there are some prior instructional materials. Otherwise this would be a trial and error game contributing very little to learning

Structure of the games

There is no clear overall glue between the games: what is in and what not varies.

2.5 UMFCV participants - Students

The first piloting of the game with students took place in Romania with 3 student cohorts from UMFCV (see table 5).



Table 5. The Cohorts for the Student Evaluation in Phase 1

cohorts of students	discipline	Games	date	Number of students
1st year students from Nursing Faculty	General Nursing	qualitative and quantitative games English version	20.02.2013 & 21.02.2013	10 - the same students took part in both sessions
4th year Students from Nursing Faculty	Community nursing	qualitative and quantitative games English version	20.02.2013 & 21.02.2013	5 – the same students took part in both sessions
6th year students at Faculty of Medicine		qualitative and quantitative games English version	21.02.2013	6 in session 2 only
Total				21

2.6 General Discussion

The findings of the phase 1 evaluation centred round the central questions of importance at this stage i. e. usability, usefulness, motivating, strong and weak points of the games and any errors, technical or content wise. During the 8 weeks of the phase 1 evaluation, many of the suggestions about more detailed feedback etc. were incorporated into the subsequent versions of the games. The feedback, following the improvements implemented, stepwise changed.

In the first prototype the participants had sometimes to endure problems due to browser or browser version specific errors or game specific implementation errors. The games became progressively more mature as these glitches were ironed out.

In line with participants' comments the focus of the feedback changed from reports on problems identified to opinions on the usefulness of the games and to what extent they were seen as being motivating and could be improved. This aligned well with the scores of the 2 groups that used the questionnaire. Overall, the first group (5 respondents) was slightly positive (average score 2.8 on a five point scale), the second group (2 respondents, 4 weeks later) was much more positive (average score 2.1). Though the overall appreciation was positive many and critical remarks were made. The comments of all 13 respondents are summarised below.

Usability. As mentioned above the first series of comments mainly targeted malfunctioning of the game. At a later stage the comments did largely focus on possible/necessary improvements. A comment returning in the feedback of a substantial part of the evaluators was the need for a more concise introduction to the exercises in the games ("Overall we need more instructions"). The ease of use was too much depending of the skills of the user. One other comment regularly returning was the need for better navigation facilities e.g. being able to go back in the game or at least to get access to the scenario of the game and the choices made and the remark that it would be better to be more consistent between the games in fonts and game graphics.

Usefulness. Many of the comments regarding the usefulness discussed the details of the games at the content level. This ranged from differences in view on the design e.g. some of the questions did not fully fit the research scenario ("At least one or more of the questions were not representative of the research article") to issues such as whether or not it is essential to have the coding categories to be defined by the students themselves ("you would not have the thematic categories and would get the students to make up the categories") and the comment that if targeting at beginners the knowledge required to play the games should be clear in advance or be part of the games ("Terminology is not always clear for beginners"). Related to this it was commented that in many places more elaborate feedback was desirable. Another comment, in particular important for the possible use of the games in teaching, is the statement that "the game is more about rehearsal, repetition and testing than about instruction". Many of the evaluators expressed the same vision in similar words.



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Motivating. In general the games were perceived well (“These games are good ways to teach statistics. They are interactive and the cases are realistic.”). However, there were also critical remarks with regard to game experience (“It is more a multimedia exercise as a game”). Additionally, the game experts did classify the games more like instruction with game elements than as games and, related to this, the score mechanism was described as “the rewards are not content related”.

Strong and weak points. The strong and weak points mentioned related to the comments given above. Weak points raised were the need to give more instructions or references and more elaborated feedback. Strong points mentioned were the overall topic of obesity. It seemed relevant, and quite easy for a broad audience to understand. Additionally, the games were perceived as useful to practice and as a formative test.

Many of the comments about the early versions of the game concerned surface issues, such as the functionality of the game or the game mechanisms not working at all or as well as they should have. Where game functionality did not work or was incorrect, this information was fed back to the game designers and corrected.

Following the early piloting where players played both the quantitative and qualitative games, players suggested that it would be better if the graphics for the qualitative games were made similar to those of the quantitative games. The games would appear more coherent. Later versions of the games incorporated this proposal.



3. Phase 2: Student Quantitative and qualitative evaluation of the CHERMUG games

Following the feedback from the phase 1 participants, many features of the games were modified. The aim of phase 2 of the evaluation was to gain feedback on student acceptance of the games, students' views about the usability of the CHERMUG games, their value in supporting learning research methods and the students' perceptions of the games and the game activities. Phase 2 involved a larger scale evaluation of the nearly final version of the games. Phase 2 lasted from April to September 2013. Surface features and errors could still be changed at this time.

3.1 Materials

Games: All 11 CHERMUG games were piloted during phase 2, although not all students had time to play all 11 games. The quantitative games were accessed online at www.playgen.com/cher mug. The qualitative games had been downloaded onto the lab computers and students accessed them there.

Surveys and online surveys: Two questionnaire surveys were developed, one for the quantitative games and one for the qualitative games. The surveys asked questions about the usability of the games (e. g. "Accessing and starting the game is simple."), the value of the games in supporting the learning of quantitative and qualitative research methods (For example: "I really learned something while playing the game.") and students' perceptions of the games (e. g. "the games was useful; the game was at an appropriate level of difficulty; the game was a waste of time; the game was interesting etc.) and the game activities (such as hangman and tic tac toe for the quantitative game and the drag and drop and coding for the qualitative game). Online versions of the surveys were developed via SurveyMonkey and 3 of the partners ran the surveys online via the Moodle sites. The questionnaires were accessed via a url placed on the Moodle site for the module.

3.2 Participants

Participants were nursing and social science students who were taking research methods and statistics modules. Some surface elements of the games and game mechanics were still changeable at this point. In practice only very superficial features of the quantitative and qualitative games were changed mainly to do with the accuracy of the materials.

There were 590 students from 8 cohorts across three European countries involved in this stage of the evaluation of the games, 114 students from the UWS in Scotland, 228 from SAMK in Finland and 248 from UMFCV in Romania (refer to Table 6). The students were recruited using a combination of purposive sample (recruiting students learning research methods as part of their course) and opportunity sampling (recruiting students from the university where each partner is based).

Table 6. The List of Cohorts for the Phase 2 Student Evaluation.

Partner	Date	Participant No.	Age	Cohort
UMFCV (Romania)	01.04.13 – 21.06.2013	248	19-45	<ul style="list-style-type: none"> • 1st, 3rd and 4th year Faculty of Nursing and Midwifery specializations: • general nurses and midwives
UWS (Scotland)	30.04.13 – 02.05.13	114	varying ages	<ul style="list-style-type: none"> • 2nd Year (Level 8) undergraduate Social Science students
SAMK (Finland)	06.2013 & 09.2013	228	20-56	<ul style="list-style-type: none"> • 2nd Year Undergraduate Nursing science students (43%) • Masters Nursing Science students (9%) • Nursing and Educational Professionals (40%)
	TOTAL	590		



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3.3 The University of the West of Scotland (UWS)

3.3.1 Participants

In the UWS, 114 Scottish undergraduate students in their 2nd year (Level 8) of a Social Science degree were recruited because they were currently undertaking an introductory core module in Social Science Research Methods. The participants were a mixture of male and female students of varying ages. Of the 114 undergraduates attending the class, 85 students completed the on-line quantitative survey and 61 completed the online qualitative survey

3.3.2 Method

The methodology comprised a combination of quantitative and qualitative approaches.

3.3.3 Materials

Online survey

The quantitative data was obtained using two online surveys, one relating to the quantitative games and one the qualitative games. The questionnaires were accessed via a url placed on the Moodle site for the module. The surveys asked questions about the usability of the games (For example: "Accessing and starting the game is simple."), the value of the games in supporting the learning of quantitative and qualitative research methods (For example: "I really learned something while playing the game.") and students' perceptions of the games and the game activities (such as hangman and tic tac toe for the quantitative game and the drag and drop and coding for the qualitative game).

The quantitative approach was to obtain descriptive data from students about The questions in the surveys were primarily Likert scale questions where participants were to indicate their response (agree, disagree, neutral) to various questions, e.g., their perceptions of the games, how they felt when playing the games, the features of the games and the usefulness of the games for learning.

The qualitative approach entailed obtaining verbal feedback on students' views about the game by asking for comments as they played the games. The comments were then transcribed and are reported in the qualitative results section.

3.3.4 Procedure

The students played the games in a lab-based revision session in the final week of the module. There were five sessions held between 30 April and 2 May 2013. As part of their module, the students were due to sit an online assessment on quantitative methods so the games session was introduced as a lab-based revision session as well as an opportunity to experience a new way of learning about research methods and statistics. The students were invited to play the games and were then encouraged to complete the online questionnaire relating to that game type (i. e., either the quantitative or qualitative survey). There were separate online questionnaires for each game, i.e., one for the qualitative games and one for the quantitative games. The students played the quantitative games first followed by the qualitative games. Not all students managed to play the qualitative games due to the time it took to play all games. Similarly not all students completed the questionnaire. The reasons for not completing the questionnaires were mainly to do with time, but were also to do with technical problems in using internet explorer.

The students' class tutor and the experimenter were in attendance. The tutor to answer questions about the game and research methods, and the experimenter was there to answer questions about the game and to elicit students' comment about the games. A staff support guide for the game was made available to the tutors prior to the session and a student support guide was made available to students prior to and during the session.



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3.3.5 Results

3.3.5.1 The Usability of the Games in Supporting Learning

In relation to the usability of the games in supporting learning, the students' responses were very positive (refer to Table 7) with 95% (qualitative) and 96% (quantitative) of students agreeing that accessing and starting the game was simple, and 68% (qualitative) and 68% (quantitative) of students agreeing the user interface was consistent and supportive. The vast majority of respondents also agreed that it wasn't difficult to understand the exercises (65% and 71%) and that they were clearly expressed (77% and 68%). The ease of use of the games was evident too with 85.5% of players agreeing that the quantitative games and 72.9% the qualitative games were easy to control.

Table 7. UWS - Usability of the games in supporting learning.

STATEMENTS	Qualitative*						Quantitative**					
	Disagree		Neutral		Agree		Disagree		Neutral		Agree	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Accessing and starting the game is simple	0	0.0	3	5.0	57	95.0	0	0.0	3	3.6	81	96.4
The game has a logical structure.	3	5.0	13	21.7	44	73.3	0	0.0	14	16.9	69	83.1
The user interface is consistent and supportive.	2	3.4	17	28.8	40	67.8	7	8.2	20	23.5	58	68.2
It is not difficult to understand the explanations.	8	13.3	13	21.7	39	65.0	7	8.4	17	20.5	59	71.1
The exercises were clearly expressed.	5	8.5	14	23.7	40	67.8	5	6.0	14	16.9	64	77.1
The exercises were not too difficult	5	8.5	17	28.8	37	62.7	7	8.3	23	27.4	54	64.3
The game was easy to control.	1	1.7	15	25.4	43	72.9	2	2.4	10	12.0	71	85.5

Note: *61 participant responses; **85 participant responses.

The ease of playing the game was also supported for the games in the verbal feedback provided by the students (refer to Table 8). Students commented that the games were easy to play and to navigate, the games were quite intuitive to play and did not require any further explanation and they were able to work out what to do next. Whilst the students liked the format of the quantitative game, the qualitative game was found to be more challenging. Although questionnaire responses to the qualitative game seemed to be less favourable, comments suggested that many students liked the qualitative game even although they perceived it to be more difficult (more challenging than quantitative; more in-depth; holds your interest more; there's more choice; It's different and more challenging). The games had been designed to be easy to use and the ease of use of the games is probably the reason that very few players felt the need to consult the student support guides.



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Table 8. UWS - Student comments relating to the usability of the games in supporting learning.

Comments about qualitative games	Comments about Quantitative games
<ol style="list-style-type: none"> 1. "More challenging than quantitative" 2. "More in-depth" 3. "Holds your interest more" 4. "There's more choice" 5. "It's different and more challenging" 	<ol style="list-style-type: none"> 1. "Easy to use" 2. "Useful" 3. "Easy to play" 4. "Extremely simple" 5. "well laid out" 6. "Layout is good" 7. "The quantitative game was good as it had a simpler layout"

3.3.5.2 The Value of the Games in Supporting Learning

As well as being easy to use, the results also indicated that the majority of respondents felt that the games has some value in supporting learning with 73.5% (quantitative) and 61.7% () of students agreeing that they really learned something while playing the quantitative and qualitative games respectively and 58% (quantitative) and 62% (qualitative) agreeing the feedback given in the game helped improve their understanding of that particular research method (refer to Table 9). This demonstrates the ability for the computer games to help improve student learning in research methods. However, in terms of motivating students to learn research methods only 48% (qualitative) and 52% (quantitative) agreed that the games motivated them to learn about research methods. While 66.3 % of respondents enjoyed the quantitative game, only 49.2 % of students said that they enjoyed playing the qualitative game. This was rather disappointing since an important reason for developing the CHERMUG games was to provide a more engaging way of learning about research methods and statistics.

Table 9. UWS - The value of the games in supporting learning of research methods.

STATEMENTS	Qualitative*						Quantitative**					
	Disagree		Neutral		Agree		Disagree		Neutral		Agree	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
I really learned something while playing the game.	8	13.3	15	25.0	37	61.7	6	7.2	16	19.3	61	73.5
I could completely concentrate on the game.	11	18.3	21	35.0	28	46.7	7	8.4	28	33.7	48	57.8
I tried hard to carry out the activities in the game.	1	1.7	14	23.7	44	74.6	4	4.8	22	26.5	57	68.7
The feedback given in the game helped to improve my understanding.	8	13.3	15	25.0	37	61.7	14	16.7	21	25.0	49	58.3
The game motivated me to learn about research methods.	9	15.0	22	36.7	29	48.3	7	8.4	33	39.8	43	51.8
The game-play is challenging.	5	8.3	19	31.7	36	60.0	11	13.3	36	43.4	36	43.4
The game supported me in learning about research methods.	5	8.5	20	33.9	34	57.6	9	11.0	15	18.3	58	70.7
I enjoyed learning with the game.	11	18.6	19	32.2	29	49.2	9	10.8	19	22.9	55	66.3
It felt good to successfully	5	8.3	15	25.0	40	66.7	5	6.0	15	18.1	63	75.9



complete the game.													
I made many mistakes while playing the game.	3	5.1	31	52.5	25	42.4	10	12.0	38	45.8	35	42.2	
I would like to be offered more games like these to support my learning.	9	15.0	16	26.7	35	58.3	4	4.8	17	20.5	62	74.7	
I would rather learn about research methods another way.	16	27.1	24	40.7	19	32.2	33	40.2	42	51.2	7	8.5	
This is a nice way to learn about research methods	4	6.8	20	33.9	35	59.3	4	4.8	16	19.0	64	76.2	

Note: *61 participant responses; **85 participant responses.

74.7% (quantitative) of students and 58.3% (qualitative) agreed that they would like to be offered more game like this to support their learning, with similar figures (76.2% and 59.3%) agreeing that this was a nice way to learn methods.

Interestingly, in the comments received about whether students felt the games helped them with their learning (table 10), the vast majority of students felt the games helped them to learn something about research methods and statistics. Several of the students commented that the quantitative games “emphasised how much they don’t know”. This response probably reflected the worries students had about the assessment they were due to sit. The students realised that the qualitative games were challenging but that they quite liked it once they worked out how it worked.

Table 10. UWS - Student comments relating to the value of the games in supporting learning.

Examples of the Qualitative Comments	Examples of the Quantitative Comments
<ol style="list-style-type: none"> 1. “Liked the coding exercise as it was more challenging and it was well explained”. 2. “I didn’t really “get” coding before”. 3. “It takes a couple of minutes to work out what is expected but it helped”. 4. “Quite liked it once I worked it out”. 5. “It helped me to learn”. 	<ol style="list-style-type: none"> 1. “The game provides different activities which is good so you don’t get too bored with one”. 2. “I like the way it presents little bits at a time. It breaks it down and you answer that bit and then link to the other bits.” 3. “Breaking it down helps to keep you engaged, moving on to the next bit” 4. “Better than a plain bland book!” 5. “It provides a new approach to learning about methods”. 6. “It’s a change”. 7. “This is a useful way to learn about research methods!” 8. “Better than the usual approach”

3.3.5.3 UWS Student Perceptions of the Games and the Games Activities:

As shown in Table 11, a higher number of students found the quantitative games (70.6%) to be useful compared to the qualitative games (55.7%) with 69.4% and 67.2% finding the games easy to use. Again, this may have been due to quantitative game being more relevant to the multiple-choice test that these students were due to sit. In addition, less than half of the students found that the games were at the correct level of difficulty for both the quantitative (41.2%) and qualitative (45.9%) games. Encouragingly, only a small number found the games boring (1.2% quantitative and 1.6% qualitative).



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Table 11. UWS Students – Perceptions of the games.

	Quantitative*		Qualitative**	
	No.	%	No.	%
Useful	60	70.6	34	55.7
Easy to Use	59	69.4	41	67.2
At correct Level of Difficulty	25	41.2	28	45.9
Interesting	24	28.2	16	26.2
Waste of Time	5	5.9	6	9.8
Repetitive	4	4.7	2	3.3
Time consuming	4	4.7	11	1.0
Too difficult	3	3.5	9	14.8
Boring	1	1.2	1	1.6
Difficult to use			1	1.6
Predictable. Once you know the pattern, you don't have to know that answer	1	1.2		
The game content is a little too simple	1	1.2		

Note: *85 participant responses; **61 participant responses.

3.3.5.4 Games Activities

In the main, the UWS students tended to prefer the activities in the quantitative games than the qualitative games. When asked which game activities they liked in the quantitative games the students much preferred the multiple-choice selections (75.9%) compared with other activities. The least popular activity was the hangman game (48.1%), which was interesting as this was the most 'game like' component of the quantitative games (refer to Table12). The popularity of the multiple choice selections could be due to this section of the game being more pertinent to these students because they were due to sit an online multiple-choice test for their research methods module.

Table 12. UWS - Quantitative Games Activities

Quantitative Games*	Disagree		Neutral		Agree	
	No	%	No	%	No	%
Hangman game	9	11.4	32	40.5	38	48.1
Multiple choice selections	3	3.6	17	20.5	63	75.9
Drag-and-drop hypothesis testing mini-game	8	10.0	30	37.5	42	52.5
Tic-Tac-Toe mini-game	7	8.6	26	32.1	48	59.3

Note: *85 participant responses.

The activities most liked by students in the qualitative games were the qualitative versus quantitative approaches (60%) where students had to select which items related to which approach (refer to Table 11b). The drag and drop mini-games contrasting qualitative and quantitative research were liked by 51.7% of participants. The least favoured activity was the level 2 and 3 coding games (36%). This may be due to the teaching of research methods at university level being more focussed on quantitative research methods than qualitative research methods in the first two years at university and therefore these 2nd year level students possibly being less familiar with qualitative research methods.



Table 13. UWS - Quantitative Games Activities

Qualitative Games*	Disagree		Neutral		Agree	
	No	%	No	%	No	%
Mini-games which contrasted qualitative and quantitative approaches.	5	8.3	19	31.7	36	60.0
Drag and drop mini-game contrasting qualitative and quantitative research.	12	20.0	17	28.3	31	51.7
Level 2 and 3 Design mini-games	9	15.3	25	42.4	25	42.4
Level 2 and 3 Coding mini-games	14	24.1	23	39.7	21	36.2

Note: *61 participant responses.

3.3.5.5 How to improve the games

In addition to students being asked about their perceptions of the games they were also asked about their views on how to improve the games and they highlighted a number of suggestions, including:

1. "Make it a puzzle game with an open world feel."
2. "Although I got to choose my character I didn't really feel I was "In the game."
3. "Give material rewards – like a bowl of apples!"
4. "It would be more interesting if there was more of a sense of progression in the game."
5. "Would like rewards when the answers were right with the quantitative game."
6. "Wouldn't like to play all (quantitative) games in the same session. Need to spread them out."
7. "No true concept of reward – you just click and get through it."
8. "Nothing to make you want to continue."
9. "Develop the idea that you're working in a research facility in quantitative game too."

3.3.5.6 Conclusion

In terms of the usability of the games in supporting learning, the Scottish students' responses were very positive. In the main, they found that the games easy to use and the games to be supportive for their learning. In terms of the value of the games in supporting their learning, the quantitative games were more favoured than the qualitative games by the students, but this may have been due to the multiple choice test they were due to sit. They found the feedback helped their learning but less than half thought the games helped with motivating them to learn about research method or were enjoyable. Whether this was due to the games or due to the research methods topic itself is unclear.

3.4 University of Medicine and Pharmacy of Craiova in Romania (UMFCV)

3.4.1 Participants

In UMFCV, 248 Romanian undergraduate students participated in this stage of the evaluation (names "phase 2"). The students were either in 1st (97 students), 3rd (66 students) or 4th (85 students) year at the Nursing Faculty. The students were mainly female (96%) and male (4%) of varying ages (19-45 years old).

3.4.2 Method

In UMFCV there were three phases of piloting CHERMUG games:

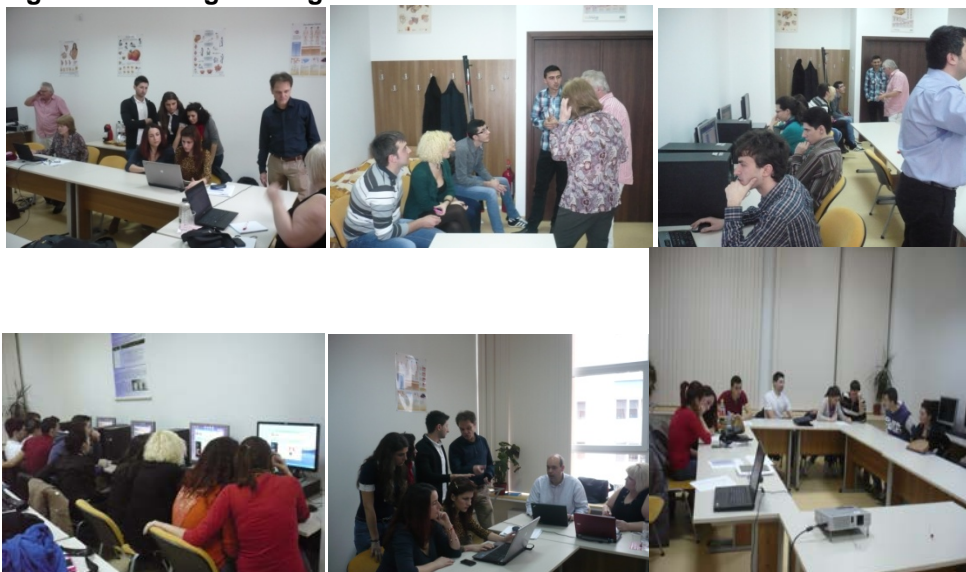


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1. "Phase 1" – Pilot of "Student training course", between 20-21.02.2013 was attended by 21 students English speaking. Repartition of the students is as follow: 10 students from 1st year of Faculty of Nursing and Midwifery, 5 students from the 4th year of the same Faculty and 6 students from the 6th year of the Faculty of Medicine – UMF Craiova. All of them were involved in playing the qualitative and quantitative games and then providing feedback for the final design of the games.
2. „Phase 2” – Running the "Student training course", between 01.04.2013 – 21.06.2013. The course was attended by 248 students from the 1st, 3rd and 4th year of the Faculty of Nursing and Midwifery, specialization general nursing (233 students) and midwives (15 students).
3. "Phase 3" – Running the Romanian version of the CHERMUG both of "pencil-on-paper" and "qualitative electronic Ro version", between 19.10.2013 -06.12.2013. The course was attended by 129 persons as follow: 27 first year students at the Faculty of Nursing and Midwifery; 58 students from 2nd year of the Faculty of Nursing and Midwifery; 12 students in 1st year at Master in Community nursing in UMFCV; 15 students from the 3rd year at the Nursing College of Craiova (pre higher education form); 17 Family Health Nurses, members of the Romanian Nursing Association.

In total, the CHERMUG courses were piloted by 398 students from Romania, in different phases of CHERMUG game design. All of them have given their feed-back by completed evaluation forms.

Figure 3: Piloting of the games in Romania



3.4.3 Results of the Phase 2

Epidemiology

In phase 2, the majority of the students were female aged between 19 and 45 year old.

Pre-test results

In UMFCV, 79% of the 248 students reported that they had knowledge about research and 86% advised they played computer games, but only 27% had ever played games during another class suggesting that using computer games for learning is currently underused. As there was very little difference in the responses between students playing the quantitative games and the qualitative games, the results have been combined. Overall, the results show that the Romanian students were very positive about all three aspects of the games, i.e., the usability of the games, the value of the games in supporting learning, and their perceptions of the games.

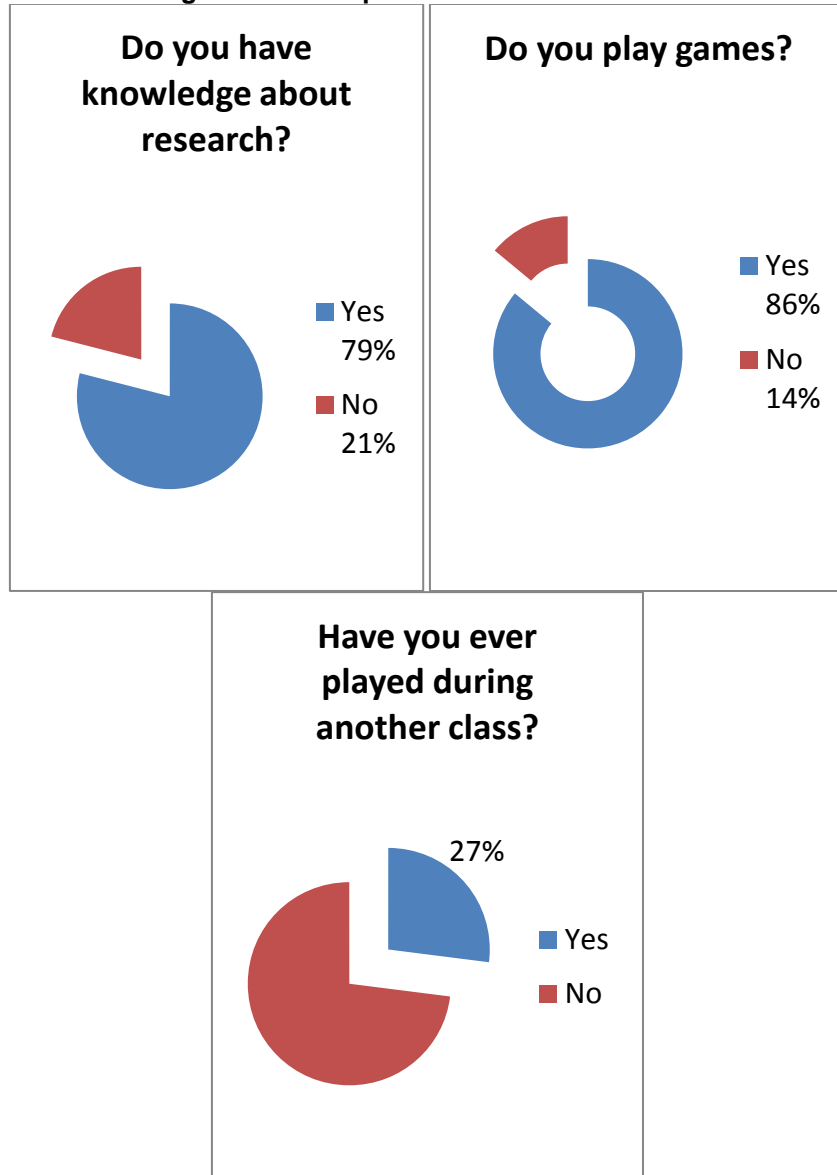


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Figure 4: Pie charts showing students responses



3.4.4 Usability of the games in supporting learning

In terms of the usability of the games in supporting learning, as Table 14 shows, the Romanian students were very positive in their responses, with the majority feeling that the games were simple to access (97%) and easy to control (97%) and a similar number feeling the interface was consistent and supportive (97%). Responses were equally positive to both the qualitative and quantitative games.



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Table 14. UMFCV students – Usability of the Games

Quantitative and Qualitative Games *	Agree	
	No.	%
Accessing the game is simple.	241	97
The game has a logical structure.	248	100
The interface is consistent and supportive.	241	97
It is not difficult to understand explanations.	231	93
The exercises were clearly expressed.	248	100
The exercises were not difficult.	238	97
The game was easy to control	238	97

Note: *248 participants

3.4.5 The Value of the Games in Supporting Learning

As shown in Table 15, the majority of Romanian students felt they learned something playing the game (93%) and that the feedback features helped them to improve their learning (90%). A possible testament to the potential value of the games in supporting learning is that all (100%) of students would like more of these types of games to support their learning of research methods with 97% saying that this was a good way to learn about the research methods. Only 10% would like to learn about research methods another way.

Table 15. UMFCV Students - Value of playing the games

Quantitative and Qualitative Games*	Agree	
	No.	%
I learned something playing the game	231	93
I could concentrate totally on the game	206	83
I tried hard to follow the game activities	52	21
The feedback helped me to improve my work	223	90
Game motivated me to learn more about research methods	179	72
The game is challenging	213	86
The game helped me learn more about research methods	241	97
I really enjoyed learning with game	231	93
I felt good when I finished the game	206	83
I made a lot of mistakes during the game	231	93
I would like to have more games like this	248	100
I prefer to learn about research in another way	25	10
This a great way to learn about the research aspect	241	97

Note: *248 participants

3.4.6 UMFCV Student Perceptions of the Games and the Games Activities:

As shown in Table 16, the majority of Romanian students perceived the games to be easy to play (76%) and useful (86%), but only 28% felt the game was at the appropriate level of difficulty. As there were not any students that thought the game was too difficult, this could suggest that the CHERMUG games were possibly too easy for the students. Interestingly however, 86% agreed they found the games challenging and 97% agreed it helped them learn more about research methods (refer to Table 11). 100% thought the games were interesting.



Figure 5: Piloting of the games in Romania



Table 16. UMFCV Students – Perceptions of the games.

Quantitative and Qualitative Games	Agree	
	No.	%
This game was easy to play.	188	76
This game was useful.	213	86
This game had an appropriate level of difficulty.	69	28
This game was too difficult.	0	0
This game was a waste of time.	0	0
This game was time consuming.	0	0
This game was interesting.	193	78
I liked the graphs.	59	24
I like how rewarding the games were.	42	17
I liked the opportunity to learn from mistakes.	248	100
The game was interesting.	248	100
The game was attractive (nice to play).	171	69
The game was fun (challenging).	102	41
The game was frustrating.	0	0
The game was boring.	17	7

Note: *248 participants

In relation to the games activities, the Romanian students seemed to prefer the activities in the qualitative games than the quantitative games (see Table 13 and 14). 100% of students agreed they liked the qualitative drag and drop activities and the level 2 and 3 design mini-games (see Table 13). However, the qualitative coding game was less popular with only 41% agreeing that they liked that particular activity. In contrast, only a minority of students agreed that they liked the quantitative game activities, with the drag-and-drop hypothesis testing mini-game being most liked (48%) and the tic-tac-toe (5%) being least liked (refer to Table 14).

Table 13. UMFCV Students (248) Liking of Qualitative Games Activities

Qualitative Games*	Agree	
	No	%
Drag and drop mini-game contrasting qualitative and quantitative research.	248	100
Level 2 and level 3 Design mini-games	248	100
Level 2 and 3 Coding mini-games	102	41

Table 14. UMFCV Students (248) – Liking of Quantitative Game Activities

Quantitative Games*	Agree	
	No	%
Hangman game	37	15
Multiple choice selections	79	32
Drag-and-drop hypothesis testing mini-game	120	48
Tic-Tac-Toe mini-game	12	5



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Table 15. Student comments about the Qualitative and Quantitative Games

Qualitative Games	Quantitative Games
<p>“games to all courses and labs”.</p> <p>“It was very interesting and I want to have these to all courses”.</p> <p>“pleasant experience and I want to use this method in future”</p> <p>“pleasure and fun”.</p> <p>“interesting”.</p> <p>“fun.”</p> <p>“I discovered things that I did not know until now, a way to understand.”</p> <p>“Enriching knowledge.”</p> <p>“learn about other people's feelings”.</p> <p>“Personally though I'm not passionate about the game but I still consider that it is interesting”.</p> <p>“new experience and fun”.</p> <p>“help you learn new things more easily”</p> <p>“can find different opinions about the same thing (obesity) learn easier”.</p> <p>“attraction for things that once doesn't interested an attraction.”</p> <p>“CONGRATULATIONS it is a nice and interesting project”.</p> <p>“Effective methods in a word invaded by computers”.</p> <p>“I would like to play more and on different topics pay attention and help to understand something, cases presented: I have discovered how people feel and I will think before pointing hem (eg because they are obese) (I was not attract by the game but also by the game topic)”</p> <p>“I learned a lot”</p> <p>“I want this to another courses too”</p> <p>“I liked very much”</p> <p>“it is an exciting little game, nice and attractive”</p> <p>“I learned in a different way than we usually do , good way, new information”</p> <p>“I think it will be a successful way to teach someone about research”</p> <p>“I learned to make the difference between qualitative and quantitative research”</p> <p>“Useful and I look for other more”</p>	<p>“I understand chi-square and t-test”.</p> <p>“I Know when to apply quantitative research”.</p> <p>“I understand that anything you want to analyze can be turned into numbers”.</p> <p>“understand quantitative research”.</p> <p>“I Know how to analyze the relationship between the variables”.</p> <p>“It is very nice, clear and instructive”.</p> <p>“the examples are good to understand quantitative research”.</p> <p>“Interesting examples”.</p> <p>“That statistic seems more attractive”.</p> <p>“I really like quantitative research”.</p> <p>“I like the idea of mini-games”.</p> <p>“I would like some games in order to understand also other aspects of statistics (for example to understand two-by-two tables, p-value and relative risk)”.</p> <p>“It is nice, but even so, I don't like too much research”.</p> <p>“There is the opportunity to learn from mistakes”.</p> <p>“I like to be rewarded and to demonstrate to my colleagues that I am the best!”</p> <p>“The rewards are nice”.</p> <p>“See where I was done mistakes it is very important for me; I appreciate to have feed-back on a paper I would like to try again and make less mistakes, than play until no more mistakes”.</p> <p>“The games has to be in Romanian language; it is easier to learn about research – because it is not simply a game”.</p>



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The evaluation also allowed students to provide comments on the games and these comments are shown in Table 15. Overall, the comments received from students were positive and covered different aspects of the game, from how they experienced the games, e.g., “it was very interesting and I want to have these to all courses”, to the value of the games for learning, e.g., “I know how to analyze the relationship between the variables”.

3.4.7 Conclusion

Despite the games being in English, the Romanian students were overall very positive about both the qualitative and quantitative games. The majority of students agreed the games were simple to access and easy to understand and control. They also agreed the games supported them with their learning of research methods and thought the games helped improve their learning. In addition, the majority of students perceived the games as being useful even though a minority of students felt the games were at an appropriate level of difficulty.

3.5 Satakunta University of Applied Sciences (SAMK)

3.5.1 Participants

228 students (aged 20-56) from a Finnish university also participated in this stage of the evaluation. They were either in their 2nd year of an undergraduate Nursing Science course (43%), a Masters level of Nursing Science (9%) or a Nursing and Educational Professional (40%). The students were a mixture of male (13%) and female (87%) students aged 20-56 years. 131 students played the qualitative games and 97 students played the quantitative games.

3.5.2 Method

The evaluation was run in June and September 2013. It should be noted that the games were run in English and not the students’ native language and this led to difficulty for some students in understanding the games. This should be considered when reading the results section.

3.5.3 Results

In SAMK, there were 131 participants who completed the evaluation sheet for the qualitative games and 97 for the quantitative games. When discussing whether students agree or disagree with the statements, the ‘completely agree’ and ‘agree’ results will be combined as will the results for the ‘completely disagree’ and ‘disagree’.

Table 16. SAMK - The usability of the qualitative games in supporting learning.

STATEMENTS	Qualitative*									
	Completely Disagree		Disagree		Bit of Both		Agree		Completely Agree	
	No.	%	No.	%	No.	%	No.	%	No.	%
Starting the game was easy.	7	5.3	25	19.1	20	15.3	58	44.3	21	16.0
The game was consistent and the structure was logical.	4	3.1	24	18.3	35	26.7	61	46.6	5	3.8
The explanations were easy to understand and helped in playing the game.	5	3.8	34	26.0	35	26.7	49	37.4	7	5.3

Note: *131 Participants



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3.5.4 The usability of the games

In terms of the usability of the games for learning, the Finnish students gave the qualitative games (refer to Table 16) higher ratings than the quantitative games (refer to Table 17). Surprisingly, considering the games were not in their native language, 60.3% (44.3% agreed; 16% completely agreed) of students agreed that starting the qualitative game was easy compared to 43% (34% agree; 9% completely agreed) of students in the quantitative game. Unsurprisingly however, only 42.7% (37.4% agreed; 5.3% completely agreed) of students playing the qualitative game agreed that the explanations were easy to understand and helped with playing the game compared to 26.8% (24.7% agreed; 2.1% completely agreed) of those playing the quantitative game.

Table 17. SAMK - The usability of the quantitative games in supporting learning.

STATEMENT	Quantitative*									
	Completely Disagree		Disagree		Bit of Both		Agree		Completely Agree	
	No.	%	No.	%	No.	%	No.	%	No.	%
Starting the game was easy.	15	15.5	27	27.8	13	13.4	33	34.0	9	9.3
The game was consistent and the structure was logical.	12	12.4	21	21.6	24	24.7	36	37.1	4	4.1
The explanations were easy to understand and helped in playing the game.	13	13.4	31	32.0	26	26.8	24	24.7	2	2.1

Note: *97 Participants

3.5.5 Perceptions of the games activities

In terms of students' perceptions of the activities within the games, the SAMK students seemed to prefer the qualitative mini-games to the quantitative games (refer to Table 18 and 19). 41.2% (36.6% agree; 4.6% completely agree) of students agreed that the qualitative mini-games were easy to play compared to 24.8% (22.7% agree; 2.1% completely agree) for the quantitative games. In addition, 52.7% (48.9% agreed; 3.8% completely agreed) of students agreed the qualitative mini-games were clear compared to 46.4% (43.3% agreed; 3.1% completely agreed) of students for the quantitative games.

Table 18. SAMK – Perceptions of the qualitative games and game activities.

STATEMENT	Qualitative*									
	Completely Disagree		Disagree		Bit of Both		Agree		Completely Agree	
	No.	%	No.	%	No.	%	No.	%	No.	%
The games mini-games were clearly understood.	4	3.1	31	23.7	26	19.8	64	48.9	5	3.8
The mini-games were easy to play.	5	3.8	35	26.7	37	28.2	48	36.6	6	4.6

Note: *131 participants



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Table 19. SAMK – Perceptions of the quantitative game activities.

STATEMENT	Quantitative*									
	Completely Disagree		Disagree		Bit of Both		Agree		Completely Agree	
	No.	%	No.	%	No.	%	No.	%	No.	%
The games mini-games were clearly understood.	10	10.3	22	22.7	20	20.6	42	43.3	3	3.1
The mini-games were easy to play.	11	11.3	36	37.1	25	25.8	22	22.7	2	2.1

Note: *97 participants

As well as students being asked to rate whether they agreed or disagreed with various statements about the games, they were also asked to rate on a scale of 1 to 10 about whether the games were a good way to learn about research methods. The qualitative games were rated slightly higher than the quantitative games with the average rating for the qualitative game being 6 compared to 5 for the quantitative game.

3.5.6 Value of the games in supporting learning of quantitative and qualitative research methods

In terms of the value of the games in supporting learning, more students agreed with the statement that the qualitative game supports their learning (40.5% - 35.9% *agreed*; 4.6% *completely agreed*) than disagreed (31.3% - 24.4% *disagreed*; 6.9% *completely disagreed*), but for the other three statements the balance for agreement/disagreement was equal (refer to Table 20).

Table 20. SAMK – The Value of the Qualitative Games in Supporting Learning of Research Methods.

STATEMENT	Qualitative*									
	Completely Disagree		Disagree		Bit of Both		Agree		Completely Agree	
	No.	%	No.	%	No.	%	No.	%	No.	%
The game supports my learning process.	9	6.9	32	24.4	36	27.5	47	35.9	6	4.6
This is a good way to learn about research methods.	12	9.2	18	9.2	26	9.2	62	9.2	12	9.2
The feedback and the tips given in the game helped me to improve my understanding.	4	3.1	17	3.1	32	3.1	64	3.1	8	3.1
The game play was motivating and challenging.	7	5.3	29	5.3	40	5.3	46	5.3	3	5.3

Note: *131 participants

In contrast, there were more students disagreeing with the statements for the quantitative games than agreeing (refer to Table 21). Only 26.8% (25.8% *agree*; 1% *completely agree*) of students agreed that the quantitative games supported their learning compared to 47.4% disagreeing (30.9% *disagree*; 16.5% *completely disagree*). 35% agreed (27.8% *agreed*; 7.2% *completely agreed*) the quantitative games are a good way to learn about research methods compared to 37.1% disagreeing (24.7% *disagree*; 12.4% *completely disagree*) and 25.7% agreeing (24.7% *agreed*; 1% *completely agreed*)



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the game play was motivating and challenging compared to 40.2% disagreeing (24.7% *disagreed*; 15.5% *completely disagreed*).

Table 21. SAMK – The Value of Quantitative Games in Supporting Learning of Research Methods.

STATEMENT	Quantitative*									
	Completely Disagree		Disagree		Bit of Both		Agree		Completely Agree	
	No.	%	No.	%	No.	%	No.	%	No.	%
The game supports my learning process.	16	16.5	30	30.9	25	25.8	25	25.8	1	1.0
This is a good way to learn about research methods.	12	12.4	24	24.7	27	27.8	27	27.8	7	7.2
The feedback and the tips given in the game helped me to improve my understanding.	11	11.3	22	22.7	29	29.9	28	28.9	4	4.1
The game play was motivating and challenging.	15	15.5	24	24.7	26	26.8	24	24.7	1	1.0

Note: *97 participants

However, when comparing the qualitative games to the quantitative games, students’ perceptions of the quantitative games seem to be more positive than the qualitative games. Although a higher number of students agreed the qualitative games (40.5%; 35.9% *agreed*; 4.6% *completely agreed*) supported their learning compared to the quantitative games (25.8%; 25.8% *agreed*; 1% *completely agreed*), the opposite was true for the remaining three statements (refer to Tables 17 and 18). 35% (27.8% *agreed*; 7.2% *disagreed*) of students agreed the quantitative games were a good way to learn about research methods compared to 18.4% (9.2% *agreed*; 9.2% *completely agreed*) for the qualitative games. 33% (28.9% *agreed*; 4.1% *completely agreed*) of students agreed the feedback and tips of the quantitative games helped to improve their understanding compared to 6.2% (3.1% *agreed*; 3.1% *completely agreed*) for the qualitative games, and 25.7% (24.7% *agreed*; 1% *completely agreed*) agreed the quantitative game play was motivating and challenging compared to 10.6% (5.3% *agreed*; 5.3% *completely agreed*) for the qualitative games.

Table 22. SAMK – A Sample of Student Comments about the Games.

Comments
“The game would be easier to carry out in Finnish”.
“The game should be in Finnish. The result will certainly influenced by the fact that I'm not very good at languages.”
“Subject is not easy, so it is difficult to play in English”.
“Exchange the Finnish language, in which case it would increase the understanding of the game”.
“Finnish-language game would be easier to play.”
“was good”
“visual clarity”
“English game. Better guidelines for what the game should do.”



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Students were also asked to comment on the games, and the aspect of the games that was important for learning was the feedback and hints as they helped students to understand the theory behind the mistake, made learning more efficient and helped with understanding and it brought interactivity to the games. The scorecards in the games were also rewarding and brought the feeling of success to the players but it was felt that more guidance should be included in the different stages of the games to further enhance students learning. Understandably, the majority of comments were about the language used in the games being English and not Finnish (see Table 22).

3.5.7 Conclusion

The main finding was that the games should be translated into Finnish to enable students to get the most out of the games. However, despite the language barrier a high number of students did feel that the games would help with learning research methods. It was also found that Y-generation students were willing to adopt the games in general, some of the games were too difficult for bachelor students (qualitative Level-3 and some quantitative games), but the games were very good for master students as they were good training for applying existing knowledge. Overall, playing of the games supports learning and the games should be used as part of the teaching process as well as for supporting students' independent studying and exam preparation.

3.5.8 Overall phase 2 Conclusion

The Romanian students were much more favourably disposed towards the games than the UK students and the Finnish students were. For example with respect to the usability of the games over 90% of the Romanian students agreed that the games were simple to access and control (97%) with only 60 % of SAMK students. Interestingly the Romanian students seemed to prefer the qualitative game over the quantitative games.



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4. Phase 3: RCT to establish the value of the games in learning about research methods and statistics

4.1 Background

Following the preliminary testing of the initial game prototype in phase 1 and the usability analysis in phase 2, phase 3 of the CHERMUG evaluation was a more rigorous evaluation designed to establish whether the CHERMUG games engage students and help them to learn about research methods and statistics. As outlined in the project proposal, a Randomised Control Trial (RCT) was planned at this stage as this is the most effective design for evaluating the effectiveness of a game for learning or behaviour change (Connolly et al, 2012). In an RCT, it is important that participants are randomly allocated to an experimental condition (in this case the game group) or a control condition. The target skills/behaviours are measured for both groups (game and control task) before and after participation in the intervention. Pre-testing should confirm no existing differences between the experimental and control groups, while post-testing should show that the experimental group performs better on the target skills than the control group.

4.1.1 Students' perceived competence on research methods and statistics

In an RCT the dependent variable is typically a measure of performance on the target skill or competence which is being trained in the intervention. The CHERMUG games aim to support players in acquiring competence in basic research and statistics. As discussed previously the skills that the CHERMUG games support are varied but quite specific. However, the learning in the CHERMUG games is of very short duration (typically about an hour) and it was thought unlikely that the CHERMUG mini-games would lead to better performance over this short time period. In addition the CHERMUG games themselves involve many multiple choice questions and it was thought that getting players to answer yet more multiple choice questions as a measure of competence would not be useful. In addition performance data was being collected in the game. An added value of the project was that the games were set up to collect data on player performance in the games and we could use this data as a measure of competence. (This is not however reported in this report)

Consequently a different approach was adopted in the phase 3 evaluation based on players' self-evaluation of their competence on research methods and statistics. The assumption was that playing the game might help players to feel more competent in this area. Self-evaluation of competence is similar to the idea of self-efficacy, a concept which was introduced by Bandura (1997) who defined it as: "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations." Self-efficacy includes both outcome beliefs, that is the belief that certain behaviours will lead to certain outcomes, and efficacy beliefs, i. e. the belief that one can perform the behaviours necessary to produce the outcomes.

Self-efficacy measures need to relate clearly to the skills under investigation. In this study we are interested in students' self-efficacy beliefs about their ability to perform the research methods skills. A 14 item questionnaire was developed asking players to self-assess their competence on the skills that the game was intended to support. Consequently the first research question for the study was to confirm that the game group and the control group had similar levels of perceived competence prior to the intervention, but to establish whether players' perceived competence on research methods and statistics was higher for the game group than the control group following the intervention.

4.1.2 Students' views of research methods and statistics

Games are considered to be highly motivating and it is this characteristic which is considered a main determinant of effective learning (Keller, 1983). The engagement that games provide could be especially important in generating interest in this notoriously abstract and difficult subject area. The use of games in learning is motivated by the aim of improving learning but also increasing motivation,



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interest and enjoyment in players. Consequently the second hypothesis examined whether players playing the games changed their views of research methods and statistics more than those in the control group after taking part in the game.

4.1.3 Students' views of the activities they took part in

While phases 1 and 2 had collected data on students' views of the usability and value of the CHERMUG games, phase 3 of the evaluation required a more rigorous evaluation of students' views of the activity that they took part in, comparing students' views of the games with their views of the control activity. A standardised measure was used to assess this, based on Deci and Ryan's (1985) self-determination theory (SDT). This is an influential account of human motivation which proposes that human behaviours are determined by very general human needs for competence, autonomy and relatedness. Ryan, Rigby, and Przybylski (2006) applied SDT to explain engagement in digital entertainment games. Consistent with Deci and Ryan's predictions, they found that players view challenge as the number one reason for playing games; similarly games frequently offer players opportunities to experience autonomy in the decisions they make as they play.

4.2 Method

4.2.1 Design

Choice of control groups: Moodle quizzes

Careful consideration was given to the choice of a control group for the evaluation of the CHERMUG games. A control group should typically carry out a task that is, as far as possible, similar to the experimental task, in this case the CHERMUG games, but which differs with respect to the specific element which is being tested, in this case the game element. Frequently a paper and pencil analogue of the task is chosen for the control group. However, much of the teaching material which is delivered on research methods modules in the partners' institutions is presented via the Moodle virtual learning environment for that module. Consequently it was decided that the most relevant control group would be a Moodle quiz version of the CHERMUG games.

Many of the tasks in the games are implemented via multiple choice questions or true/false questions. The aim was to replicate this functionality in Moodle but without the game elements. Moodle quizzes offer many different question types, such as multiple choice, true or false, matching, drag and drop, random short answer matching, selecting missing words. Many of the quantitative activities were implemented as multiple choice or true/false items but the game elements in the quantitative game, such as tic tac toe, hangman and the drag and drop elements were not included in the Moodle quizzes. For example the hangman items were implemented in the Moodle quizzes via multiple choice selections. The hypothesis testing was implemented as 3 separate multiple choice activities. The tic tac toe mini-game provided an element of choice and luck concerning which items to select but this element of choice was not offered with the Moodle exercises. Instead with the Moodle exercises 3 of the 9 tic tac toe items were selected to be presented. The feedback mechanism in Moodle was slightly different too. Whereas feedback in the game is provided immediately after answering any question, with the Moodle exercises feedback is provided when all question for that activity have been answered. The level 1 qualitative items which were implemented in the game as drag and drop items were implemented in Moodle in multiple choice format with 2 alternatives (quantitative or qualitative). The level 2 and 3 qualitative coding activities were implemented as a matching question activity in Moodle.

4.2.2 Ethical issues

Of course carrying out an experimental comparison of this kind does raise ethical issues. The games were designed with the hope that they would improve engagement in and learning of research methods and statistics. The point about carrying out an RCT is to try and show better performance with the experimental group than the control group. However, from the student experience perspective, the control group activity should also be engaging in some way. It is not acceptable in



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Higher education to provide students with activities which are thought not to be useful or engaging. It was hoped that the Moodle quizzes did engage the learners to some extent. The Moodle quizzes were a rigorous control group to use as a comparison since students might find these equally useful and engaging, but it was felt that this would help to separate out the effects of e-learning from games.

Since OUNL run their modules via online delivery it was decided that OUNL would use the Moodle control group and run their evaluation study online. In UWS teaching is carried out face-to-face but Moodle is used to support teaching. UWS would set up the games and exercises to be accessed through the Moodle site but they would run most of the evaluation in a lab-based setting. This would also allow a comparison of lab-based delivery compared with online delivery of the games.

Choice of control groups: Paper and pencil control: Frequently the control group in an intervention study carries out a paper and pencil analogue of the target activities and it was thought that it would be interesting to also include a paper and pencil comparison group. Another reason for carrying out the paper and pencil comparison was that setting up the Moodle control group required a considerable amount of time and technical expertise and that some partners did not feel able to devote the time to do this. Since UMFCV did not have easy access to Moodle, they would run a paper and pencil control group version of the 2 qualitative games. SAMK have a Moodle site for students and they ran the game version via the Moodle site. SAMK would run a paper and pencil control group version of the 4 quantitative games selected for phase 3 evaluation. They collected pre- and post- test data via Moodle.

4.2.3 Evaluation design

Figure 6 shows the evaluation framework for Phase 3 of the CHERMUG evaluation. It shows the sequence of activities for the game group and the Moodle exercises group.

Figure 6: The phase 3 evaluation framework

Group 1 (experimental group - game)	Group 2 (control group– Moodle exercises)
Pre-test on <ul style="list-style-type: none"> Demographics/ personal Information Views of research methods and statistics perceived competence on research methods and statistics 	Pre-test on <ul style="list-style-type: none"> Demographics/ personal Information Views of research methods and statistics perceived competence on research methods and statistics
Qualitative game 1	Qualitative exercise 1
Quantitative games 1, 2, 3 & 4	Quantitative exercises 1, 2, 3 & 4
Qualitative game 2	Qualitative exercise 2
Post-test on <ul style="list-style-type: none"> Views of research methods and statistics perceived competence on research methods and statistics motives for/ views about games/ activities game usability Game score, game time, no of games completed in-game performance measures 	Post-test on <ul style="list-style-type: none"> Views of research methods and statistics perceived competence on research methods and statistics motives for/ views about games/ activities game usability Game score, game time, no of games completed in-game performance measures



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4.2.4 Measures and Materials

4.2.4.1 Selection of games for phase 3

The phase 2 piloting of the CHERMUG games had established that each quantitative and qualitative mini-game typically takes between 5 and 10 minutes to play, although the time taken was quite variable with some students taking up to 15 minutes to play one mini-game. Due to the time required to play each quantitative and qualitative mini-game it was decided that a reduced number of games should be piloted in phase 3. The games selected were thought to be representative of all the games. Consequently 2 qualitative games (levels 1 and 2) and 3/4 quantitative games (1/2 chi-square and 2 t-tests) were selected for the phase 3 piloting. This restriction on the number of games tested in phase 3 was because some of the piloting was frequently being done in a 90 minute laboratory session and students had to complete the pre and post tests and all the games within this time. The quantitative games selected for the phase 3 piloting were:

- Quantitative Game 1: Gender & Reward (chi square)
- Quantitative Game 2: Skipping meals and obesity (chi square)
- Quantitative Game 3: Nationality and Mediterranean foods (t test)
- Quantitative Game 4: Type of diet and weight loss (t test)

4.2.4.2 Pre-test measures

Demographics and game use

The pre-tests for both games and quizzes collected basic demographic information about students including their gender, age, discipline of study, a self-evaluation of their level of expertise at research methods, game playing habits and game use (see Appendix 1).

Pre and post-test measures

The main dependent measures for phase 3 of the study are (a) students' perceived competence on research methods and statistics and (b) students' views of research methods and statistics.

The pre and post-test measures of students' perceived competence on research methods and stats

This section of the questionnaire provided a 13/14 item measure developed to assess students' perceived competence on research methods and statistics with respect to the knowledge and skills that the games aimed to support (see Appendix 2). The same test was used on the pre-test and the post-test. Participants were asked to indicate their agreement to statements about their perceived competence on research methods and statistics, where 1 meant strongly disagree and 5 meant strongly agree. Possible scores for each participant ranged from 13(14) to 65 (70).

The pre and post-test measures of students' views of research methods and statistics

Students' views about research methods and statistics prior to and following their participation in the game along the dimensions interesting, boring, enjoyable, useful, difficulty were examined (see Appendix 3). The enjoyment/interest/boring and usefulness dimensions are similar to those used by Deci and Ryan in their self-determination theory but are single item measures. Participants were asked to indicate their agreement to statements about their views on research methods and statistics, where 1 meant strongly disagree and 5 meant strongly agree. Each item was analysed individually.

4.2.4.3 Post-test measures

Students' views of the activities they took part in

In addition to the pre- and post-test measures of students' views of research methods and self-assessment of perceived competence on research methods and statistics, data was also collected about the students' views of the activity that they took part in whether this was game, exercise or paper and pencil task. Questions in this section were derived from Deci and Ryan's (2000) Intrinsic Motivation Inventory (IMI) (see Appendix 4). The scales used were a 7 item scale for motivation (Interest/Enjoyment), (example item: "I enjoyed doing this activity very much"), a 6 item scale for



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Perceived Competence), (example item: “I think that doing this activity is useful for getting to know my strong and weak points in research methods.”), and a 6 item scale for Value/Usefulness, (example item: “I believe this activity could be of some value to me”). Perceived competence should enable us to position the user with regard to how they perceive their competence in this area. Usefulness should give us feedback on how the students perceive the usefulness of the games (or mc-questions). Participants were asked to indicate their agreement to the statements about their feelings about the activities that they had taken part in, where 1 meant strongly disagree and 5 meant strongly agree.

4.2.4.4 Performance data

The games and exercises also collected data on student performance on the games/exercises. The data that were collected in the quantitative games included Game/exercise score, time to play the game/exercise and the number of games/exercises completed.

4.2.4.5 Phase 3 in-game performance measures

In addition to this basis performance data, the qualitative and quantitative games had both been designed to allow for the collection of some behavioural data from the students, including the actual responses which they gave to the different questions, response times, etc.

Added value of behavioural data

Both the qualitative and quantitative games had been designed to allow for the collection of some behavioural data from the students. This data included the actual responses which players gave to the different questions, response times, etc. While the project proposal had not promised to collect this kind of data, there is much interest in players’ responses and behaviours while playing games (behavior analytics) and what this can add to our understanding of player engagement and learning and looking this data provided an opportunity for the project to provide some added value. Since this data was beyond the scope of the project, it will not be discussed in this report.

4.2.4.6 Setting up the CHERMUG games and exercises to run via Moodle

Setting up the CHERMUG games and exercises to collect the behavioural data proved to be tricky since it required that the games and the exercises should be run via Moodle. This required a reasonably high level of technical knowledge about Moodle. The alternative for the quantitative games was to set up the games so that students would collect and return their response sheets electronically to their tutors. It was decided that there was too much scope for error with this method of returning data. Consequently both OUNL and UWS ran both the CHERMUG games and the CHERMUG Moodle exercises through the relevant Moodle sites.

The CHERMUG quantitative games are online games while the CHERMUG qualitative games have to be downloaded onto a player’s local computer to be played there. Both the CHERMUG quantitative and qualitative games can also be delivered by setting them up to be accessed by students from a Moodle site. PLAYGEN provided a SCORM package for setting up the games to run via Moodle. Instructions about how to set up the CHERMUG quantitative games to run in Moodle are shown in Appendix 5.

4.2.4.7 Advantages of running the games via Moodle

However setting up the games and exercises to run via Moodle also had the advantages of:

- Using Moodle to run the game (and control group Moodle exercises) had the advantage that data on the pre-tests and post-tests could also be collected via Moodle.
- It allowed for the collection of the additional behavioural data and this could be collected via the Moodle site.



4.2.4.8 Difficulties in setting up games through Moodle

A number of problems emerged in returning data about the quantitative and qualitative games to the OUNL and UWS Moodle sites. While the games generally ran very well when they are simply run as games through the Moodle site, when trying to collect the behavioural data through Moodle, a number of problems arose. The tricky combination of running online games (quantitative) or downloaded games (qualitative) with Scorm packages, unreliable internet connections, and server connectivity issues, in addition to specific implementation issues related to students' personal computer set-ups at home for online delivery and interactions between these led to data storage problems and data loss for both quantitative and qualitative games. Consequently collection of data from online students was a bit patchy.

4.3 Results

The results of the phase 3 analysis will be reported by each partner institution.

4.3.1 UWS Phase 3 results

4.3.1.1 UWS participants

A number of different cohorts took part in phase 3 of the evaluation from UWS and these are shown in table 23. Altogether 213 participants took part (115 in the game group and 98 in the exercises group). 68 4th year Psychology dissertation students (33 games and 35 exercises), 73 3rd Year Research Methods students in psychology (39 games and 34 exercises), 15 Masters Students Research Methods in drugs and alcohol (10 games and 5 exercises) and 30 students from Ayr College (HNC Level -- Research Methods) (16 games and 14 exercises) accessed the games via their Moodle site in the context of a laboratory session as part of their methods module. In addition 23 nursing students on a Critical Appraisal Module (13 games and 10 exercises), accessed the game online as part of their module.

UWS students were generally randomly assigned to the different conditions on the basis of their seminar groups and typically these are determined alphabetically.

Table 23: UWS phase 3 participants

UWS Cohorts	Subject Discipline	Place of Data Collection	Date of Data Collection	Actual Student No.		ACTUAL TOTAL
				Games	Exercises	
4th Year Dissertation Students	Psychology	Lab	09/09/2013	37	35	72
3rd Year Research Methods students	Psychology	Lab	14/10/2013 & 04/11/2013	39	34	73
Critical Research Appraisal (online)	Nursing	Online	04/11/2013-18/11/2013	13	10	23
Masters Students Research Methods	Alcohol & Drugs	Lab	10/12/2013	10	5	15
Ayr College Students (HNC Level - Research Methods)	Social Sciences	Lab	11/11/2013 & 14/11/2013	16	14	30
TOTALS				115	98	213



4.3.1.2 Procedure

The CHERMUG games and the CHERMUG Moodle exercises were loaded onto the relevant Moodle site for the 5 different modules and students accessed the CHERMUG games and the CHERMUG Moodle exercises through the Moodle site for the relevant module.

At the start of each lab session, participants were given a hard copy of the instructions about how to access the games/ exercises including a short description of the games/exercises and guidance about the order in which they should be completed (see Appendix 6).

4.3.1.3 Results

4.3.1.3.1 Students' perceived competence on research methods and statistics pre and post intervention

The key question for the phase 3 evaluation was whether players' ratings of their perceived competence on research methods and statistics increased more for players in the games condition compared with the exercises condition. Players' mean competence ratings were assessed by the 13 item measure in Appendix 2. All UWS students had the opportunity to take part in both qualitative and quantitative games so any changes occurred as a result of playing both kinds of games.

Table 24 shows a summary of the mean perceived competence scores collapsed across cohorts for the games group and the exercises group before and after taking part in the activity. Overall, before taking part in the game/exercise mean scores were the same (2.91). After intervention, ratings for both the games group (3.48) and the exercises group (3.00) increased, but the games group increased more than the exercises group. This shows that perceived competence scores for both groups increased following the intervention but the scores for the games group increased by .57 while the Moodle exercises group only increased by .09.

Table 24: UWS mean perceived competence scores

	Games		Exercises		Both	
	pre	post	Pre	Post	pre	post
4th years	3.54	3.82	3.69	3.72	3.68	3.74
3rd years	3.16	3.29	3.37	3.18	3.27	3.28
HNC	2.25	2.59	2.28	2.44	2.37	2.44
Masters	2.86	3.18	2.91	2.73	2.98	2.94
Nursing	2.76	4.5	2.29	2.93	3.18	3.24
	14.57	17.38	14.54	15		
	2.91	3.48	2.91	3	3.1	3.13

Cleaned data

In the previous analysis several participants had missing data and further analyses were carried out after cleaning the data so that only participants with a full set of data were included. Table 25 shows the mean scores on the competence measures for this subset of participants for the games group and the exercise group before and after taking part in the activity, collapsed across cohort. The independent samples t-tests (table 26) show that the perceived competence scores for games (3.10)



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and exercises (3.25) groups were not significantly different before the intervention nor following the intervention with scores for games (3.34) and exercises (3.24). However the table 25 also shows that scores for the games group increased from 3.10 before intervention to 3.34 after the intervention, while scores for the exercise group decreased slightly from 3.25 before to 3.24 following the intervention. This suggests that only scores for the games increased as a result of the intervention.

Difference scores for perceived competence were calculated (i. e post-test score minus pre-test score) and table 27 shows the results of an ANOVA with the difference scores as the dependent variable and cohort, control group, gender, age and level as independent variables. The only significant main effect was for control group which shows that the difference in score for the game group from before to after the intervention (.24) was bigger than for the exercises group where it actually decreased by .01.

Table 25: UWS mean perceived competence scores (after data cleaning)

Group Statistics

	ControlGroup	N	Mean	Std. Deviation	Std. Error Mean
PreComp	Games	100	3.10426	.796363	.079636
	Exercise	92	3.25035	.806370	.084070
PostComp	Games	90	3.33796	.837883	.088321
	Exercise	87	3.24078	.803400	.086134

Table 26: Independent samples t tests on mean perceived competence ratings

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower		Upper
PreComp	Equal variances assumed	.052	.819	-1.262	190	.208	-.146090	.115740	-.374390	.082210
	Equal variances not assumed			-1.262	188.254	.209	-.146090	.115800	-.374523	.082343
PostComp	Equal variances assumed	.013	.908	.787	175	.432	.097186	.123456	-.146467	.340840
	Equal variances not assumed			.788	174.989	.432	.097186	.123367	-.146293	.340666



Table 27: ANOVA on difference scores

Tests of Between-Subjects Effects

Dependent Variable: DiffComp

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8.069 ^a	12	.672	1.414	.164
Intercept	1.255	1	1.255	2.638	.106
Cohort	3.175	4	.794	1.669	.160
ControlGroup	2.157	1	2.157	4.536	.035
Gender	1.074	1	1.074	2.259	.135
Age	1.746	4	.437	.918	.455
Level	1.739	2	.870	1.829	.164
Error	76.561	161	.476		
Total	86.260	174			
Corrected Total	84.630	173			

a. R Squared = .095 (Adjusted R Squared = .028)

Cohorts

Players' mean competence scores for the 5 different UWS cohorts for the games and exercises before and after the intervention (see table 28) show that mean confidence ratings prior to the intervention indicated that 4th years were most confident in their competence ratings in research methods and statistics (3.68), with lower ratings by 3rd years (3.27), nurses (3.18) and Master students (2.98). As might be predicted the HNC group were least confident and tended to disagree with statements about their competence (2.37). Mean scores for all cohorts increased from before to after the intervention for the games group, while ratings for the exercises increased for the 4th years, HNC and nurses but decreased for the 3rd years and Masters students. There were however quite large differences between the pre scores for nursing cohorts and 3rd years.

Table 28. Average Perceived Student Competence Scores for each Cohort

Cohort	Condition	Test	*No. of Competence Items included	Total Ratings Score	Mean Ratings Score	**Highest Rating Score achievable
4th Years	Games	Pre	13	46.03	3.54	65
		Post	13	49.60	3.82	65
	Exercises	Pre	12	44.23	3.69	60
		Post	12	44.66	3.72	60
3rd Years	Games	Pre	14	44.22	3.16	70
		Post	14	46.09	3.29	70
	Exercises	Pre	12	40.46	3.37	60
		Post	13	41.39	3.18	65
HNC	Games	Pre	14	31.56	2.25	70
		Post	14	36.26	2.59	70
	Exercises	Pre	13	29.64	2.28	65
		Post	14	34.15	2.44	70
Masters	Games	Pre	14	40.10	2.86	70
		Post	14	44.50	3.18	70



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Nursing	Exercises	Pre	13	37.80	2.91	65
		Post	14	38.25	2.73	70
	Games	Pre	14	38.67	2.76	70
		Post	14	63.00	4.50	70
	Exercises	Pre	13	29.75	2.29	65
		Post	14	41.00	2.93	70

Further analysis of changes in perceived competence items

To examine changes in perceived competence in more detail, selected analyses were carried out on two of the items in the perceived competence scale. Table 29 shows the contingency table for a chi-square analysis looking at the relationship between pre and post ratings on the item “Know the main steps of research study”. These items were collapsed across games and exercises. The chi square was significant, ($p < 0.000$) with the percentage claiming little or no competence decreasing from 15.8% to 10.5% and the percentage claiming competence or high competence increasing from 46.8% (80/171) to 61.4% (105/171). This is encouraging in suggesting that could mean that learning has taken place or that repeated use has made the steps more clear.

Table 29 Contingency table for “know main steps of research study” before and after intervention

		Pre: Know main steps of research study					Total
		not competent at all	limited skill	average competence	competent	highly competent	
Post: Know main steps of research study	No competence	1	5	1	0	0	7
	Little competence	1	5	4	1	0	11
	Average Competence	2	9	26	10	1	48
	Competent	0	3	26	38	7	74
	Highly Competent	0	1	7	8	15	31
Total		4	23	64	57	23	171

Table 30 shows a chi-square analysis looking at the relationship between pre and post rating on the item “Know the differences between quantitative and qualitative approaches to research”. Again chi square was significant, ($p < 0.000$). The percentage claiming little or no competence has decreased from 4 to 3, and the percentage who claim competence or high competence has increased slightly from (53/77) to 61.4% (60/77). This could mean that learning has taken place or that repeated use has made the steps more clear.



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Table 30 Contingency table for “Know the differences between quantitative and qualitative approaches to research” before and after intervention

		Pre: Know the differences between quantitative and qualitative approaches to research					Total
		not competent at all	limited skill	average competence	competent	highly competent	
Post: Know the differences between quantitative and qualitative approaches to research	No competence	0	0	2	0	0	2
	Little competence	0	0	0	1	0	1
	Average competence	1	1	6	3	3	14
	Competent	0	2	12	20	5	39
	Highly Competent	0	0	0	5	16	21
	Total	1	3	20	29	24	77

4.3.1.3.2 Students’ views of research methods and statistics before and after intervention

In addition to looking at students’ perceived competence on research methods and statistics, phase 3 of the evaluation also looked at players’ views of research methods and statistics based on the view that taking part in the activities might change players’ views. The relationship between the ratings given by students before and after taking part in the game or exercises was examined in 5 separate chi squared analyses on the different items: interesting, boring, enjoyable, useful and difficulty. This analysis did not distinguish between games and exercises. Relative changes in responses to agreement (strongly agree and agree) and disagreement (disagree and disagree) were of interest. The chi square contingency tables below show participants’ ratings before and after the intervention.

Research methods and statistics are interesting

With respect to the question “Research methods and statistics are interesting”, there was a highly significant association between students’ responses before and after participating in the game or exercise (chi square $p < 0.001$) (table 31). The percentage of students agreeing with the statement “Research methods and statistics are interesting” increased from 18.5% (32/173) before the intervention to 35.3% (61/173) after the intervention, while the percentage disagreeing decreased from 43.5% (75/173) before the intervention to 34.1% (59/173) after the intervention. This suggested a general trend towards finding research methods and statistics more interesting following the game or exercise intervention.



Table 31 Contingency table for “RM and statistics are interesting” before and after intervention

		Pre: RM and statistics are interesting					
		completely disagree	disagree	neither agree or disagree	Agree	completely agree	Total
Post: RM and statistics are interesting	completely disagree	6	12	2	1	0	21
	Disagree	2	14	16	6	0	38
	neither agree or disagree	3	9	36	5	0	53
	Agree	4	12	10	15	0	41
	completely agree	11	2	2	2	3	20
Total		26	49	66	29	3	173

Research methods and statistics are really enjoyable

With respect to the question “Research methods and statistics are really enjoyable”, there was a highly significant association between students’ responses before and after participating in the game or exercise (chi square, $p < 0.001$) (table 32). The percentage agreeing with the statement “Research methods and statistics are really enjoyable” increased from 14.4% (25/173) before the intervention to 38.13% (66/173) after the intervention, while the percentage disagreeing decreased from 50.1% (88/173) before the intervention to 29.5% (51/173) after the intervention. This indicated that students found research methods and statistics more enjoyable after playing the game or exercise intervention.

Table 32 Contingency table for “Research methods and statistics are really enjoyable” before and after intervention

		Pre: RM and statistics are really enjoyable					
		strongly disagree	disagree	Ambivalent	Agree	strongly agree	Total
Post: RM and statistics are really enjoyable	completely disagree	6	9	1	0	1	17
	Disagree	7	18	5	4	0	34
	neither agree or disagree	5	14	31	4	2	56
	Agree	6	13	13	6	1	39
	completely agree	6	4	10	4	3	27
Total		30	58	60	18	7	173

Research methods and statistics are boring

With respect to the question “Research methods and statistics are boring”, there was a highly significant association between students’ responses before and after participating in the game or exercise (chi square, $p < 0.001$) (see table 33). The percentage agreeing with the statement “Research methods and statistics are boring” fell from 38.3% (64/167) before the intervention to 28.7% (48/167) after the intervention, while the percentage disagreeing increased from 28.7% (48/167) to 37.7%



(63/167) after the intervention. This suggests that following the intervention students tend to find research methods and statistics less boring.

The pattern of results for the items enjoyment, interesting and boring suggests that these items may address a similar construct.

Table 33 Contingency table for “Research methods and statistics are boring” before and after intervention

		Pre: RM and statistics are boring					Total
		completely Disagree	Disagree	neither agree or disagree	Agree	completely Agree	
Post: RM and statistics are boring	completely disagree	6	0	1	5	10	22
	Disagree	4	15	17	6	1	41
	neither agree or disagree	4	10	28	11	4	56
	Agree	1	6	8	13	3	31
	completely agree	0	2	4	4	7	17
Total		15	33	58	39	25	167

Research methods and statistics provide useful skills

With respect to the question “Research methods and statistics provide useful skills”, there was a highly significant association between students’ responses before and after participating in the game or exercise (chi square value?, $p < 0.01$) (see table 34). The percentage agreeing with the statement “Research methods and statistics provide useful skills” decreased from 74.4% (128/172) before the intervention to 66.9% (115/172) after the intervention, while the percentage disagreeing increased slightly from 8.1% (14/172) before the intervention to 11.0% (19/172) after the intervention. This result is not what was predicted and suggests that following the intervention students are slightly less likely to think that research methods and statistics provides useful skills.

Table 34 Contingency table for “Research methods and statistics provide useful skills” before and after intervention

		Pre: RM and statistics provide useful skills					Total
		strongly disagree	disagree	Ambivalent	Agree	strongly agree	
Post: RM and statistics provide useful skills	completely disagree	1	1	3	0	0	5
	Disagree	0	1	4	3	6	14
	neither agree or disagree	3	2	10	16	7	38
	Agree	0	4	10	41	20	75
	completely agree	0	2	3	13	22	40
Total		4	10	30	73	55	172



Research methods and statistics are difficult

With respect to the question “Research methods and statistics are difficult”, there was a significant association between students’ responses before and after participating in the game or exercise (chi square, $p < 0.01$) (table 35). The percentage agreeing with the statement “Research methods and statistics are difficult increased from 45.9% (79/172) before the intervention to 52.9% (91/172) after the intervention, while the percentage disagreeing decreased from 28.7% (42/172) to 16.9% (29/172) after the intervention. Perhaps the interventions have highlighted the complexity of research methods and statistics, making this clearer to students?

Table 35 Contingency table for “Research methods and statistics are difficult” before and after intervention

		Pre: RM and statistics are difficult					Total
		strongly disagree	disagree	Ambivalent	Agree	strongly agree	
Post: RM and statistics are difficult	completely disagree	3	1	1	0	0	5
	Disagree	1	10	6	5	2	24
	neither agree or disagree	5	11	18	15	3	52
	Agree	2	3	24	32	3	64
	completely agree	0	6	2	11	8	27
Total		11	31	51	63	16	172

The pre and post-test measures of students’ views of research methods and statistics

In this section mean scores for students’ views about research methods and statistics prior to and following their participation in the games or exercises, along the dimensions interesting, boring, enjoyable, useful and difficulty, are examined. Table 36 shows the mean scores for games and exercises for the 5 items measuring students’ views of research methods and statistics pre- and post-intervention.

Table 36 Means scores for students’ views of research methods and statistics before and after intervention collapsed across cohort

	games		exercises		both	
	pre	post	pre	post	pre	post
interesting	2.44	2.16	2.65	2.61	2.55	2.39
boring	3.13	3.41	3.1	3.12	3.12	3.27
enjoyable	2.26	2.43	2.72	2.40	2.49	2.42
useful	3.75	3.81	3.69	3.90	3.72	3.86
difficult	3.19	3.26	3.48	3.43	3.34	3.35



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Usefulness of research methods and statistics

The results show that before the intervention, students tend to view research methods and statistics as providing useful skills (3.72) with this subscale having the highest mean rating. Students also view research methods and statistics as both difficult (3.34) and boring (3.12). The lower mean ratings on interesting (2.55) and enjoyable (2.49) suggest that, as both previous research and tutors' experiences have shown, students tend not to agree that research methods and statistics are interesting or enjoyable.

The intervention confirms students' views about the usefulness of the skills with ratings increasing marginally to 3.86. There was little difference between the games and exercises group before the intervention with a slightly larger increase for the exercises. There was little difference in students' views about difficulty pre (3.34) to post (3.35), while ratings for boring actually increased pre to post. Students in the exercises group rated research methods as more difficult prior to the intervention.

There is a problem with the data in that the means for enjoyable (games: 2.26 and exercises: 2.72), difficult (games: 3.19 and exercises: 3.48) and interesting (games: 2.44 and exercises: 2.65), before the intervention were different. It is not clear why there would be an existing difference for groups which were randomly assigned (by alphabetical name).

Table 37 shows mean ratings for students' views of research methods and statistics before and after intervention for the different cohorts.



Table 37 Means ratings for students' views of research methods and statistics before and after intervention

		Games		Exercises	
		Pre	Post	Pre	Post
Interesting	4th	2.17	2.17	2.7	2.39
	3rd	2.78	2.64	2.97	2.97
	HNC	1.82	1.64	2.57	2.71
	Masters	3	2.2	2.33	2
	Nursing			2.67	3
Boring	4th	2.4425	2.1625	2.648	2.614
	3rd	3.3	3.6	3.12	3.42
	HNC	3.22	3.31	2.97	3.09
	Masters	3.82	3.91	3.07	3.14
	Nursing	2.2	2.8	2.67	3.67
Enjoyable	4th	2.17	2.07	2.48	2.42
	3rd	2.56	2.64	2.79	2.76
	HNC	1.91	1.82	2.64	2.36
	Masters	2.4	3.2	2.67	1.67
	Nursing			3	2.67
Useful	4th	3.9	3.9	4.21	4.33
	3rd	4	4.14	4.52	4.3
	HNC	2.91	2.82	3.07	3.21
	Masters	4.2	4.4	3.33	3.67
	Nursing			3.33	4
Difficult	4th	3.63	3.6	3.58	3.52
	3rd	3.17	3.31	3.21	3.67
	HNC	2.55	2.73	1.93	2.64
	Masters	3.4	3.4	4.67	4
	Nursing			4	3.33

4.3.1.3.3 Students' views of the activities they took part in (games or exercises)

Students' views of the activities that they took part in were examined using the 3 Deci and Ryan scales looking at motivation, competence and usefulness. The mean ratings for all cohorts for the UWS participants for the games and exercises group are shown in table 38.



Table 38: Students' views of the activities they took part in (games or exercises)

All cohorts games and exercises			
	Motivation	Competence	Value
Games	3.19	3.00	3.66
Exercises	2.97	3.03	4.01
	3.08	3.02	3.84

Value

The mean score of 3.84 (where 4 means agree) for value indicated that overall the students viewed both the games and exercises as being of some value. An ANOVA with value as the dependent measure and control group (games/exercises), gender and age, level and cohort as variables showed that control group was significant with students' ratings of value for exercises (4.01) being higher than that for games (3.66) ($F(1,174)$, $p=.035$), indicating that students agreed that the Moodle exercises were valuable in helping them to learn about research methods and statistics, more so than the games! While this was not what we had predicted, it is reassuring that students view both as activities as being of some value. It may be that the students are more used to the Moodle exercises and regard them of some value but are less used to games. There may be a tendency to view games as being in some way not serious and not valuable for that reason.

Table 39: Students' ratings and ANOVA results for students' views of value of activities

Descriptive Statistics

Dependent Variable: Value

ControlGroup	Mean	Std. Deviation	N
Exercise	4.0077	.84063	87
Games	3.6648	1.06058	88
Total	3.8352	.97018	175

Tests of Between-Subjects Effects

Dependent Variable: Value

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5.144 ^a	1	5.144	5.610	.019
Intercept	2575.315	1	2575.315	2808.547	.000
ControlGroup	5.144	1	5.144	5.610	.019
Error	158.633	173	.917		
Total	2737.861	175			
Corrected Total	163.777	174			

a. R Squared = .031 (Adjusted R Squared = .026)



Tests of Between-Subjects Effects

Dependent Variable: Value

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	38.193 ^a	12	3.183	4.465	.000
Intercept	170.477	1	170.477	239.154	.000
ControlGroup	3.212	1	3.212	4.506	.035
Gender	.206	1	.206	.289	.591
Age	1.949	4	.487	.683	.604
Level	1.921	2	.961	1.348	.263
Cohort	14.804	4	3.701	5.192	.001
Error	113.340	159	.713		
Total	2707.167	172			
Corrected Total	151.533	171			

a. R Squared = .252 (Adjusted R Squared = .196)

Motivation

The mean rating for motivation of 3.08 (across games and exercises) suggests that students are relatively neutral with respect to whether they found the activities interesting and enjoyable. The mean rating for games (3.19) was higher than the rating for exercises (2.97). As table 40 shows a one tailed t-test on independent samples was nearly significant ($F(1, 172) = 2.568, p = .055$), suggesting a trend for students to find the games more interesting and enjoyable than the exercises.

Table 40: Students' ratings and ANOVA results for students' views of activities as motivating
Descriptive Statistics

Dependent Variable: Motivation

ControlGroup	Mean	Std. Deviation	N
Exercise	2.9737	.81500	87
Games	3.1872	.93787	87
Total	3.0805	.88256	174

Tests of Between-Subjects Effects

Dependent Variable: Motivation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.982 ^a	1	1.982	2.568	.111
Intercept	1651.126	1	1651.126	2139.007	.000
ControlGroup	1.982	1	1.982	2.568	.111
Error	132.769	172	.772		
Total	1785.878	174			
Corrected Total	134.751	173			

a. R Squared = .015 (Adjusted R Squared = .009)



Competence

The mean score of 3.02 for competence (where 4 means agree) suggests that students do not feel especially confident about their performance on the activity. There was little difference between the competence scores for games (3.00) and exercises (3.03) suggesting that students viewed themselves as equally competent at the games and exercises.

Table 41: Students’ ratings and ANOVA results for students’ views of their competence on the activities

Descriptive Statistics

Dependent Variable: Competence

ControlGroup	Mean	Std. Deviation	N
Exercise	3.0000	.76398	86
Games	3.0345	.79165	87
Total	3.0173	.77594	173

Tests of Between-Subjects Effects

Dependent Variable: Competence

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.051 ^a	1	.051	.085	.771
Intercept	1574.895	1	1574.895	2601.808	.000
ControlGroup	.051	1	.051	.085	.771
Error	103.508	171	.605		
Total	1678.611	173			
Corrected Total	103.559	172			

a. R Squared = .000 (Adjusted R Squared = -.005)

4.3.1.3.4 Conclusion

Overall the results suggest that the UWS students enjoyed the games marginally more than the exercises, felt equally competent at both activities but viewed the exercises as being of greater value than the games.

4.3.1.3.5 UWS PHASE 3: QUALITATIVE RESULTS

UWS 3rd Year (Research Methods) comments on Exercises

For the 3rd year research methods group, comments about the exercises were collected as they took part in the piloting and these are shown below. Generally comments were positive:

Positives

“The exercises were insightful. They let you see what you definitely need to brush up on and some of it is transferable into dissertation”.



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"It gives an indication for MCQ (multiple choice questionnaires) that we are getting for this module and this will help prepare us for that".

"It is pitched at the right level and gives enough so I can brush up on".

"I would definitely make use of them outwith uni, especially with the MCQ's coming up".

"It is a good way to test knowledge and assess what you should do".

"The difficulty level was right and the time spent was okay."

"It is a good indication of how you are doing as it is reflected in the score".

"I enjoyed it and thought it was quite good. You are made aware of what you are good and pretty bad at e.g., bad at diagrams and what types of test should be used, but good at variables."

However the students also had suggestions for improvement:

Negatives

"Some of the feedback was wrong which made you wonder about the answers you thought were right".

"It is repetitive and instead of it just being the same type of questions being asked, they could add in more".

"I think another option of 'not sure' should be put in so that students do not get awarded marks for something they guessed".

"The jury's out. I can see the advantages because it shows you the terminology and if it is familiar it is good. But you can't crosscheck your answer and it can be a hit or miss."

"Some of the questions were running in to each other and I was getting muddled because they were so many questions that were the same".

"By test six I was getting lower marks because I was finding it hard to keep concentration after 1hr 20minutes"

"It would be more useful if it explained the feedback than just telling you the answer".

Neutral

"I would like to have access to do the whole thing at home where I can concentrate and be in the right mindset for it".

"I would be more inclined to use it in a seminar than in my own time because I prefer to revise my own way."

Some of these comments reflect the lack of time to develop the games, since in the two year project a game had to be designed, developed and evaluated and written up.



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4.3.1.4 Discussion

An important conclusion from the current study is that, while it is useful to compare overall performance with the game versus Moodle exercises, it is probably more useful to look at exactly how the activities are implemented in the games and in Moodle. The Moodle activities were implemented as far as possible using similar activities but without the game element. The game included several game mechanics but the evaluation of the game did not allow for a detailed, finer grained analysis of which game mechanisms worked most effectively.

4.3.2 OUNL phase 3 results

4.3.2.1 OUNL Participants

Table 42 below shows details of the OUNL participants. All students were online students and all were volunteers. Students accessed the games and exercises via the Moodle site for their module. Originally 90 students registered to take part in the study of whom 47 were assigned to the game condition and 43 to the exercise condition. Of those, 63 started the study (30 games and 33 exercises) and 45 (22 games and 23 exercises) finished. With respect to subject discipline of the students, 23 were Psychology students, 20 were Educational sciences students and 20 were “other”. Ages ranging from 18 to 65 with the far majority of the students being at least above 30 (being representative of the distance teaching students at the OUNL).

Assigning participants to groups In this study, students were generally randomly assigned to the different conditions on the basis of their seminar groups and typically these are determined alphabetically.

Table 42: OUNL phase 3 participants

	Registered No.		Registered Total	Started No		ACTUAL TOTAL	Completed* No		ACTUAL TOTAL
	Games	Exercises		Games	Exercises		Games	Exercises	
Psychology						23			
Learning sciences						20			
Other domains						20			
	47	43	90	30	33	63	22	23	45

4.3.2.2 Design and procedure

The design and procedure for OUNL participants was similar to that for UWS students apart from the fact that all students participated online and in a period of 3 weeks in which they could plan the activities themselves.

4.3.2.3 Results (due to time limitations only means will be reported)

4.3.2.3.1 Students’ perceived competence on research methods and statistics

Students’ perceived competence scores (on the 13 item measure of competence) on research methods and statistics were compared before and after taking part in the games/exercises. Table 43 shows that before taking part in the games/exercises, the mean perceived competence score was 3.19 and after it was 3.65 (collapsed across games and exercises). It seems that the mean perceived



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competence score increased for both games and exercises: for games this increased from 2.95 to 3.56 (difference score= .61) and for exercises from 3.43 to 3.73 (difference score=.3).

Table 43 also shows the results for students’ views of research methods using the items boring, enjoyable, useful and difficult. Before the intervention participants tended to agree that research methods and statistics provide useful skills (4.38) and this decreased slightly following the intervention (4.34). They also viewed games as difficult (3.19) and this increased slightly following the intervention (3.65) possibly suggesting that the games alerted students to the difficulty. They tended to disagree that methods is boring (2.13) and this decreased slightly following the intervention (2.09). They viewed games as difficult (3.19) and this increased slightly following the intervention (3.65), possibly suggesting that the games alerted students to the difficulty They were neutral about whether research methods and statistics were enjoyable (2.98) but this increased following the intervention (3.23) suggesting that the interventions increased perceptions that research methods and statistics are enjoyable.

Table 43: Students’ views of research methods and perceived competence scores before and after taking part in the games/exercises.

	Boring	Enjoy	Useful	Difficult	Perceived competence
Game (Pre)	2,00	3,09	4,59	3,68	2,95
Game (Post)	2,32	3,23	4,32	3,50	3,56
Moodle exercises (Pre)	2,13	2,87	4,17	3,61	3,43
Moodle exercises (Post)	2,09	3,22	4,35	3,57	3,73
Games and Moodle exercises (Pre)	2.07	2.98	4.38	3.19	3.19
Games and Moodle exercises (Post)	2.21	3.23	4.34	3.65	3.65
Games and Moodle exercises (collapsed across pre and Post)	2.14	3.10	4.36	3.59	3.42

4.3.2.3.2 Students’ views of the activities that they took part

The mean scores for the OUNL participants for the games and exercises group for the three Deci and Ryan scales: motivation (7 item), competence (6 item) and usefulness (6 item) are shown in table 44. Also shown is the mean response to the item: “more of this”. Mean scores for games for all subscales are slightly higher than the mean scores for the exercises on all of the items: the mean for motivation for games was 4.19 and for exercises was 3.91; the mean for competence for games was 3.48 and for exercises was 3.44; the mean for competence for games was 4.08 and for exercises was 3.80. The mean for “more of this” was 4.23 for games and 4.00 for exercises. These results suggest that students were quite motivated to do the activity and regarded it as quite useful and would like more similar activities but the smaller scores and differences for competence suggests that students are not sure that they feel competent in doing the activity (game or exercises).

Table 44: mean scores on motivation, competence and usefulness and “more of this” for students’ motive for the activity

	Motivation	Competence	Usefulness	More of this
Exercises	3.91	3.44	3.80	4
Games	4.19	3.48	4.08	4.23
Games and exercises	4.05	3.46	3.94	4.12



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Figures 7 shows the distribution of students' responses to the 3 Deci and Ryan scales: motivation (7 item scale), Perceived Competence (6 item scale) and Value/Usefulness (6 item scale).

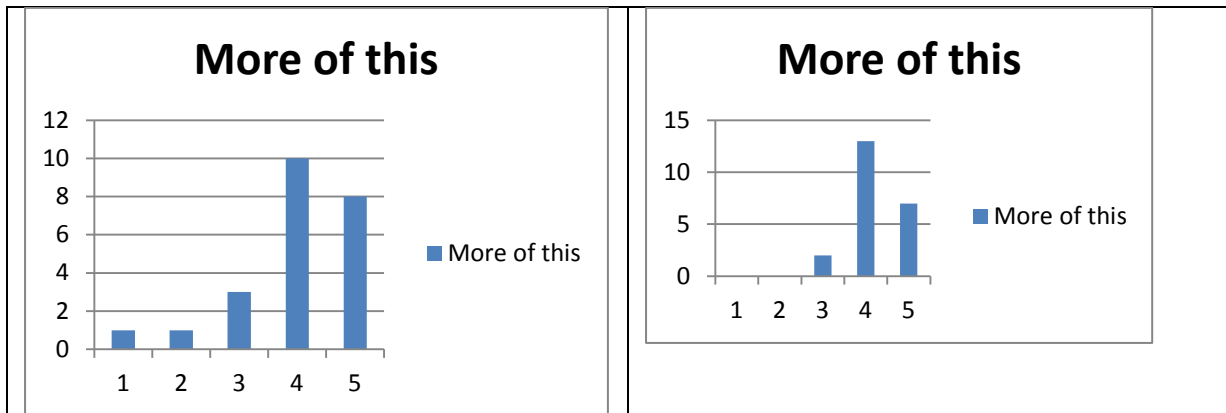
Figures 7 the distribution of students' responses to the 3 Deci and Ryan scales

Exercises	Games																								
<p style="text-align: center;">Motivation</p> <table border="1"> <caption>Exercises Motivation Data</caption> <tr><th>Scale</th><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><th>Count</th><td>0</td><td>1</td><td>6</td><td>12</td><td>4</td></tr> </table>	Scale	1	2	3	4	5	Count	0	1	6	12	4	<p style="text-align: center;">Motivation</p> <table border="1"> <caption>Games Motivation Data</caption> <tr><th>Scale</th><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><th>Count</th><td>0</td><td>0</td><td>3</td><td>12</td><td>7</td></tr> </table>	Scale	1	2	3	4	5	Count	0	0	3	12	7
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<p style="text-align: center;">Post Perceived Competence</p> <table border="1"> <caption>Exercises Post Perceived Competence Data</caption> <tr><th>Scale</th><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><th>Count</th><td>0</td><td>1</td><td>10</td><td>12</td><td>0</td></tr> </table>	Scale	1	2	3	4	5	Count	0	1	10	12	0	<p style="text-align: center;">Post Perceived Competence</p> <table border="1"> <caption>Games Post Perceived Competence Data</caption> <tr><th>Scale</th><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><th>Count</th><td>0</td><td>0</td><td>11</td><td>9</td><td>2</td></tr> </table>	Scale	1	2	3	4	5	Count	0	0	11	9	2
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<p style="text-align: center;">Usefulness</p> <table border="1"> <caption>Exercises Usefulness Data</caption> <tr><th>Scale</th><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><th>Count</th><td>0</td><td>3</td><td>2</td><td>14</td><td>4</td></tr> </table>	Scale	1	2	3	4	5	Count	0	3	2	14	4	<p style="text-align: center;">Usefulness</p> <table border="1"> <caption>Games Usefulness Data</caption> <tr><th>Scale</th><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><th>Count</th><td>0</td><td>2</td><td>0</td><td>10</td><td>10</td></tr> </table>	Scale	1	2	3	4	5	Count	0	2	0	10	10
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4.3.3 UMFCV PHASE 3 RESULTS

Frequently the control group in an intervention study carries out a paper and pencil analogue of the target activities and it was thought that it would be useful to include a paper and pencil comparison group. Another reason for carrying out the paper and pencil comparison was that setting up the Moodle control group required a considerable amount of time and technical expertise. UMFCV did not have easy access to Moodle, they ran a paper and pencil control group version of the 2 qualitative games (level 1 and level 2). UMFCV collected the pre and post test data by paper and pencil. They ran the game so that the performance data could be collected via UCM's server. SAMK ran a paper and pencil control group version of the 4 quantitative games.

4.3.3.1 UMFCV participants

Table 45 UMFCV Phase 3 cohort

UMFCV Cohort	Subject Discipline	Place of Data Collection	Date of Data Collection	No of participants		
				1st meeting	2nd meeting	Total
2nd Year Research Methods Students from Nursing Faculty	Nursing research methods	Lab	19.10.2013 26.10.2013	25	33	58
1st year Master students	Community nursing research methods	Lab	25/10/2013	12		12
3rd Year students from Nursing College	Research methods	classroom	08/11/2013	15		15
Family Health Nurses - Nursing Association	Post-graduate NA course	classroom	09/11/2013	17		17
1 st year students from Nursing faculty		Nursing laboratory		27		27
TOTAL				69	33	129



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Table 45 shows details of the UMFCV participants. A total of 129 students from Romania across 5 different cohorts took part in phase 3 of the evaluation. The course was attended by 129 persons as follow: 27 first year students at the Faculty of Nursing and Midwifery; 58 students from 2nd year of the Faculty of Nursing and Midwifery; 12 students in 1st year at Master in Community nursing in UMFCV; 15 students from the 3rd year at the Nursing College of Craiova (pre higher education form); 17 Family Health Nurses, members of the Romanian Nursing Association.

The first cohort (29 students) played the electronic version of the CHERMUG qualitative games, while the last 4 cohorts (102 students) took part in the paper and pencil control. UMFCV collected the pre and post test data by paper and pencil. With the electronic versions of the qualitative games performance data was collected via UCM's server. The data were collected between 19.10.2013 - 06.12.2013.

4.3.3.2 Materials

The materials for the UMFCV Phase 3 cohort including the pre-test questionnaires, the paper and pencil versions of levels 1 and 2 qualitative games and the post-test control group are shown in Appendix 7.

Since the Romanian study concentrated on the qualitative research approach the number of perceived competence items was reduced to the seven items shown below.

1. Know main steps of research study
2. Know the differences between quantitative and qualitative approaches to research
3. Able to identify research scenarios typically qualitative and quantitative
4. Able to setup simple research design
5. Able to Define Research Question & Hypothesis
6. Able to select main variables and type
7. Can code qualitative data

4.3.3.3 Results

4.3.3.3.1 Students' perceived competence on research methods and statistics

Table 46. Average Perceived Romanian Student Competence Scores for each Cohort

Cohort	Condition	Test	*No. of Competence Items included	Total Ratings Score	Mean Ratings Score	**Highest Rating Score achievable
All Participants	Games	Pre	7	7.00	1.00	35
		Post	7	31.33	4.48	35
	Paper&Pencil	Pre	7	13.41	1.92	35
		Post	7	34.02	4.86	35
2nd Year	Paper&Pencil	Pre	7	16.07	2.30	35
		Post	7	34.21	4.89	35
1st Yr Master	Paper&Pencil	Pre	7	17.58	2.51	35
		Post	7	35.00	5.00	35
3rd Yr preHE	Paper&Pencil	Pre	7	7.00	1.00	35
		Post	7	33.80	4.83	35
Practitioner Nurse	Paper&Pencil	Pre	7	7.06	1.01	35
		Post	7	32.88	4.70	35
1st Yr Students	Paper&Pencil	Pre	7	7.00	1.00	35
		Post	7	31.89	4.56	35



Table 46 shows the mean ratings for each UMFCV cohort on the perceived competence measures for the games group and the exercise group before and after taking part in the activity. Overall, before taking part in the game/exercise the intervention perceived competence for the games group was 1 (on a scale of 1 to 5 where 1 meant strongly disagree and 5 meant strongly agree with the statement). This possibly reflected the fact that the cohort who took part in the games (1st year students from Nursing faculty) did not have expertise in qualitative research. However after playing the games these students' mean perceived competence score increased dramatically to 4.48 indicating that they really felt the game helped them to understand qualitative methods. Students doing the paper and pencil exercises also showed dramatic increases in scores from pre (1.92) to post test (4.86). There was more variability in pre competence score before the intervention reflecting the greater variation in abilities of the different groups who took part in the paper and pencil control. All paper and pencil control groups showed increases in perceived competence from pre to post test.

Table 47. Summary table of average ratings for views for games and exercises pre to post intervention

		Interesting	Boring	Enjoyable	Useful	Difficult
Games	Pre	1.70	2.33	2.19	3.26	4.33
	Post	4.33	1.00	4.00	4.07	1.41
Difference pre to post		2.63	-1.33	1.81	0.81	-2.93
Paper & Pencil	Pre	2.11	3.14	1.36	3.05	2.98
	Post	3.44	1.82	4.04	4.36	1.37
Difference pre to post		1.33	-1.31	2.68	1.31	-1.61

4.3.3.3.2 Students' views of research methods and statistics

Table 47 shows the mean scores for games and exercises for the 5 items measuring students' views of research methods and statistics: interesting, boring, enjoyable, useful and difficult. As with other cohorts, the ratings indicated that before the intervention, students tend to view research methods and statistics as difficult but providing useful skills, and they tend to disagree that it is interesting and enjoyable. This cohort also tended to disagree that it is boring.

Table 47 also shows difference scores from pre to post and these show big increases after playing the game: students' ratings for interesting increased by 2.63, for enjoyable increased by 1.81 and for usefulness also increased by .81, indicating that the short game based intervention helped these first year students to find research methods more interesting, enjoyable and useful. Scores for "research methods is difficult" decreased by 2.93 indicating that the game helped students to find research methods easier. Students tended not to agree that research methods was boring before the intervention but this still decreased following the intervention by 1.33 following the intervention.

Interestingly similar trends were evident for those doing the paper and pencil exercises. Table 48 shows the scores for the different cohorts.



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Table 48. Summary table of average ratings for views for games and exercises pre to post intervention for the different cohorts

		Games		Paper & Pencil	
		Pre	Post	Pre	Post
Interesting	2nd Yr RM			1.72	3.48
	1st Masters			4.00	3.75
	3rd Yr PreHE			2.73	3.40
	Nurses			1.53	3.12
	1st Yr Nursing	1.70	4.33		
Boring	2nd Yr RM			2.93	1.53
	1st Masters			1.58	2.33
	3rd Yr PreHE			3.87	2.07
	Nurses			4.29	2.24
	1st Yr Nursing	2.33	1.00		
Enjoyable	2nd Yr RM			1.28	3.84
	1st Masters			1.58	4.58
	3rd Yr PreHE			1.40	4.33
	Nurses			1.47	4.06
	1st Yr Nursing	2.19	4.00		
Useful	2nd Yr RM			2.93	4.28
	1st Masters			3.67	4.83
	3rd Yr PreHE			2.73	4.60
	Nurses			3.29	4.12
	1st Yr Nursing	3.26	4.07		
Difficult	2nd Yr RM			4.47	1.52
	1st Masters			1.00	1.00
	3rd Yr PreHE			1.00	1.20
	Nurses			1.06	1.29
	1st Yr Nursing	4.33	1.41		

4.3.3.3 Students' views of the activities that they took part

The mean scores for the UMFVC participants for the games and exercises group for the three scales: motivation, competence and usefulness are shown in table 49. The scores suggest that they perceived the activities as being of value (mean=4.5) and enjoyable (4.44) and that they felt reasonably competent on both (3.64). The games (4.74) were perceived as being of more value than the paper and pencil exercises (4.38) but the mean rating for these was still quite high. Ironically, given the work that went into developing the games, the paper and pencil exercises (4.44) were perceived as equally enjoyable (4.44)! Ratings for competence were higher for paper and pencil exercises than games possibly reflecting the students' lack of experience with games for learning.

Table 49 mean scores on motivation, competence and usefulness and "more of this" for students' motive for the activity

Romanian (POST)			
	Motivation	Competence	Value
Games	4.44	3.51	4.74
Paper & Pencil	4.44	3.77	4.38
	4.44	3.64	4.56



4.3.4 SAMK RESULTS

4.3.4.1 SAMK: Phase 3 cohorts

43 students took part in the pre-test and 13 in the post-test. Half the students (the game group) played the games and half (the control group) did the paper and pencil version of the games. The SAMK students played the quantitative games. Only the paper and pencil version was completed.

Table 50. The Cohorts for the SAMK Student Evaluation in Phase 3

SAMK Cohorts	Subject Discipline	Place of Data Collection	Date of Data Collection	Actual Student No.		ACTUAL TOTAL
				Games	Exercises	
4th Year Dissertation Students	Nursing	Lab	11/12/2013			43 pre-test 13 post-test

4.3.4.2 Materials

The materials for the SAMK Phase 3 cohort including the pre-test questionnaires, the paper and pencil versions of the 4 selected quantitative games and the post-test control group are shown in Appendix 8.

In the original planning, SAMK were going to compare the game group with a paper and pencil control but, due to ethical issues, they are carrying out a slightly different version of the design to that planned. Staff had previously told the students that they were going to play the games so they feel duty bound to allow students to play the game. The design therefore was as follows. All students will first carry out the pre-test (in paper and pencil format). Then half of the students will do the game and half will do the paper and pencil tests. The groups will then swap over and will carry out the other activity, ie students who did the game will do the paper and pencil tests and students who did the paper and pencil tests will do the game. The paper and pencil tests are the same as the games but without the game element.

4.3.4.3 Respondents

Students (2 groups) N= 57 were informed about project and this research and 44 were willing to participate on a voluntary basis, they did at that time the pre-test and there are pre-test results for 44 students.

A group of 43 students would participate on the evaluation session on 11 December 2013. In practice from the first group 11 students did the post-test and from the second group 3 students.

4.3.4.4 Results

Given the limited amount of respondents it was decided that an analysis was not useful. An explanation for the limited number of respondents was that the connected research method course only runs in the spring period. Moreover, it was difficult to attract motivated students in particular since the evaluation was in the examination period.



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4.4 Discussion

One of the main strengths of the CHERMUG project was the originality of the 2 different approaches taken to developing a game in the area of research methods and statistics where very few games previously existed.

The task of developing games in this area was more difficult than we had originally thought. While we had originally thought a role playing game would be good the tasks and activities required did not seem to require distinct roles.

One of the problems with the project was the need to come up with a working product. While there was rigorous evaluation of the games, there was nevertheless always a feeling that “if only we had more time we could develop something better”. Once the games had been developed, the rest of the process had to continue even if we felt that there was a better product.

Although the project partners had impressive levels of expertise in the relevant areas, especially research methods and game design, the subject area seemed to be especially difficult.

Finally, overall it seems clear that the students do appreciate and find it useful to have the possibility to get hands-on activities, be it exercises or games, to assess and train their knowledge and skills in research methods and statistics.

5. References

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6. Appendix 1: Demographics and Information questionnaire

This short questionnaire asks you some basic information about your background. Please indicate your response by ticking the appropriate box.

1. Which university do you attend?

1	Open University of the Netherlands	<input type="checkbox"/>
2	University of the West of Scotland	<input type="checkbox"/>
3	Satakunta University of Applied Sciences	<input type="checkbox"/>
4	Universidad Complutense de Madrid	<input type="checkbox"/>
5	University of Medicine and Pharmacy of Craiova	<input type="checkbox"/>
6	Other	<input type="checkbox"/>

2. What gender are you?

1	male	<input type="checkbox"/>
2	female	<input type="checkbox"/>

3. Which of the following categories includes your age?

1	17 or younger	<input type="checkbox"/>
2	18-29	<input type="checkbox"/>
3	30-39	<input type="checkbox"/>
4	40-49	<input type="checkbox"/>
5	50-59	<input type="checkbox"/>
6	60 or older	<input type="checkbox"/>

4. Which kind of student are you?

1	Full-time undergraduate	<input type="checkbox"/>
2	Part-time undergraduate	<input type="checkbox"/>
3	Full-time postgraduate	<input type="checkbox"/>
4	Part-time postgraduate	<input type="checkbox"/>
5	Other	<input type="checkbox"/>

5. Please select the subject discipline of your studies

1	Nursing	<input type="checkbox"/>
2	Social science	<input type="checkbox"/>



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3	Health	
4	Education	
5	Learning science	

6. Which of the following best describes your level of expertise with research methods and statistics?

1	Student with little or no knowledge of research methods	
2	Student with at least a basic understanding of research methods	
3	Student with a good understanding of research methods	
4	Teacher	
5	Researcher	

7. Do you play computer games?

1	yes	
2	no	

8. Please rate the frequency with which you on average play computer games

1	Less than one hour per week	
2	2-4 hours a week	
3	Up to 2 hours a day	
4	More than 2 hours a day	

9. Please rate, from 1 to 7, how much you like the following kinds of computer games, where 1 means not at all and 7 means very much. Circle your answer.

First person shooters. Like for example, the sagas Call of Duty (Black Ops), Borderlands, Halo or Bioshock.	1	2	3	4	5	6	7
Adventure games and thrillers. Examples: sagas Uncharted, Heavy Rain, Resident Evil or Assassin's Creed.	1	2	3	4	5	6	7
Rhythm games (singing, dancing and music). Examples: sagas Guitar Hero, Sing Star or Just Dance.	1	2	3	4	5	6	7
Fighting games. Examples: sagas Tekken, Mortal Kombat or Street Fighter.	1	2	3	4	5	6	7
Brain and knowledge testing games. Examples: Brain Training, Trivia o Brain Academy.	1	2	3	4	5	6	7
Strategy games. Examples: Civilization, Age of Empires, Command and Conquer or Starcraft.	1	2	3	4	5	6	7



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Sports and racing games. Examples: FIFA, PES, NBA Live, Gran Turismo or Need for Speed	1	2	3	4	5	6	7
Platformers and/or party games. Examples: Super Mario, Mario Kart, Wii Party or Wii Sports.	1	2	3	4	5	6	7
Massively Multiplayer Online Games. Examples: World of Warcraft, Farmville, or NeverWinter Nights.	1	2	3	4	5	6	7
Simple, social games (e.g. Wordfeud)	1	2	3	4	5	6	7



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Appendix 2: The pre and post-test measures of self-assessment of perceived competence on research methods and statistics

		1	2	3	4	5
1	I know the main steps of a research study.					
2	I know the differences between quantitative and qualitative approaches to research.					
3	I am able to identify research scenarios typical of either qualitative or quantitative research.					
4	I am able to set-up a simple research design (what, where, who, how many).					
5	I am able to define a research question and connected hypothesis.					
6	I am able to select the main variables of a study and their type.					
7	I am able to select and use common data representations such as histogram, contingency tables, box-plots.					
8	I am able to apply statistical tests such as chi-square.					
9	I am able to apply statistical tests such as the t-test.					
10	I am able to apply a coding scheme to a set of qualitative data.					
11	I am able to read the statistical output of a chi-square test.					
12	I am able to read the statistical output of a t-test.					
13	I am able to determine the significance of a chi-square test.					
14	I am able to determine the significance of a t-test.					



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Appendix 3: The pre and post-test measures of views of research methods and stats

		1	2	3	4	5
1	I find research methods and statistics interesting.					
2	I find research methods and statistics boring.					
3	I really enjoy research methods and statistics.					
4	Learning about research methods and statistics provides me with useful skills.					
5	I find research methods and statistics difficult.					



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Appendix 4: Adapted version of the IMI for CHERMUG games with coding for items

Interest/Enjoyment (7 items)

1. I enjoyed doing this activity very much.
2. This activity was fun to do.
3. I thought this was a boring activity. (R)
4. This activity did not hold my attention at all. (R)
5. I would describe this activity as very interesting.
6. I thought this activity was quite enjoyable.
7. While I was doing this activity, I was thinking about how much I enjoyed it.

Perceived Competence (6 items)

8. I think I am pretty good at this activity.
9. I think I did pretty well at this activity, compared to other students.
10. After working at this activity for a while, I felt pretty competent.
11. I am satisfied with my performance at this task.
12. I was pretty skilled at this activity.
13. This was an activity that I couldn't do very well. (R)

Value/Usefulness (7 items)

14. I believe this activity could be of some value to me.
15. I think that doing this activity is useful for getting to know my strong and weak points in research methods.
16. I think this is important to do because it can help me to improve my studying habits.
17. I would be willing to do this again because it has some value to me.
18. I think doing this activity could help me to practice my research methods skills.
19. I believe doing this activity could be beneficial to me.
20. I think this is an important activity.



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Appendix 5: Instructions for loading the CHERMUG scorm package into Moodle


Log into Moodle

2. Navigate to the module
3. Turn editing on (top right)
4. Under add an activity select 'add scorm package'
5. Enter the name of game
6. Add description if required

ADDING A NEW SCORM PACKAGE

General


Name* Chermug

Description* 
game

Path: p

Display description on
Module page
Package file

Choose a file...


You can drag and drop files here to add them

7. Then Click chose a file.....



8. Make sure upload a file is selected
9. Click browse...
10. Locate the file and click it then click open



11. Add details as required then click upload this file



12. Scroll down and then click 'save and return to module'
13. The game will now be on your module front page
14. Click the game
15. Then click enter
16. It may take a few minutes (about 10 minutes the 1st time it is used)



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17. You may then get a warning, if you do click on I accept the risk.. then click run



18. You will now be asked for the code that chermug have provided.

Many Thanks

Sam Coulter

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Appendix 6: Moodle and hard copy instructions for phase 3 UWS participants

CHERMUG games

The CHERMUG project has developed a number of games which are designed to offer you an active way to engage with research methods and statistics which will help you to learn. The games are aimed at students who are currently taking a beginners' module in research methods or statistics. They can also be used as a short refresher course for more advanced students.

Altogether there are there are 8 quantitative and 3 qualitative games but in this session you will only do 2 of the qualitative and 3 or 4 of the quantitative games. The games follow a cycle in which the research process is presented as a problem-solving activity with different tasks performed at different phases of the cycle. Each exercise highlights specific aspects of the cycle from defining the research question, through data collection and data analysis to the interpretation of results phase.

The games that we are going to look at all concern the obesity problem in Europe. Obesity is one of the greatest public health challenges of the 21st century. The UK has the largest percentage of adults who are obese with 23% of adults obese. This is followed by the Slovak Republic and Greece.

Go to the Google chrome browser, open the UWS Moodle site (moodle.uws.ac.uk) and login. The exercises for this session are all on the MOODLE DISSERTATION SITE, under CHERMUG Games. So first of all go to this site. You should access the activities in the following order.

1. First of all you should complete the questionnaire called **Consent, demographics and information**. Select this icon and when it turns yellow, click on it to open it. You will see a screen that says attempt quiz now. The questionnaire asks about your background including age, gender, experience of computer games and your views about and competence with research methods and statistics.

2. Next you will do the Research Methods and Statistics games. You should carry these out in the order shown below. It's a good idea to tick off the exercises on this sheet as you finish them.
 1. **Qualitative game level 1: differences between qualitative and quantitative approaches**
 2. **Quantitative Game 1: Gender & Reward**
 3. **Quantitative Game 3: Nationality and Mediterranean foods**
 4. **Quantitative Game 4: Type of diet and weight loss**
 5. **Qualitative game level 2: Study design and coding**

If you have time go back and do **Quantitative Game 2: Skipping meals and obesity**

Qualitative games

To start: From the CHERMUG GAMES site on Moodle, select the game that you want to play (Qualitative level 1 or qualitative level 2). When the name turns yellow, click on it to open the game. The game can take a while to load. If you are then asked to give permission for Java to run – select



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“always run on this site” from the Java toolbar at the top of the screen. You should then see a screen which says E-adventure and then a window will appear asking “Do you want to run this application”. Click on “I accept the risk and want to run this application”. Another window appears asking whether to block potentially unsafe components from being run. Click on “do not block” and the game should open.

At the end of the game click on exit activity (in the top right hand corner) to return to the main site (CHERMUG GAMES) to select the next game.

Please note that the qualitative games can take a couple of minutes to download. Please be patient! You might also need to centre the presentation of the games on the screen by minimizing the tab on the left hand side of the game (click on the double arrows on the blue tab called “Qualitative Games – Level 1”) or by maximising the window size or moving your mouse.









Quantitative games

To start: From the CHERMUG GAMES site on Moodle, put your cursor over the game that you want to play. When the name turns yellow, click on it to open the game. Then press enter. Wait a few moments while the game loads and then play the game!

At the end of each quantitative game you will see a results screen with your time, score, rank and achievements. You will also see a “print results” tab. If you click on this you will get a more detailed summary of your responses and whether they were correct. You will also see an option to actually print your results but **PLEASE DON'T DO THAT!** Simply click on exit activity (in the top right hand corner) to return to the main site (CHERMUG GAMES) to select the next game.

1. **Once you have completed the games, you will complete the final questionnaire on motives, competence and your perceptions of the games, called post games questionnaire.**

THANK YOU FOR PLAYING THE CHERMUG GAMES! The other CHERMUG games will be available on the Moodle dissertation site for you to practice soon.

-  [games consent, demographics and information v.3 Quiz](#)
-  [Qualitative game level 1: differences between qualitative and quantitative approaches v.3 SCORM package](#)
-  [Quantitative game 1: Gender and Reward v.3 SCORM package](#)
-  [Quantitative game 2: Skipping Meals and Obesity v.3 SCORM package](#)
-  [Quantitative game 3: Nationality and Mediterranean Foods v.3 SCORM package](#)
-  [Quantitative game 4: Type of Diet and Weight Loss v.3 SCORM package](#)
-  [Qualitative game level 2: Study design and coding v.3 SCORM package](#)
-  [Post games questionnaire v.3 Quiz](#)



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Appendix 7: UMFCV: Phase 3 cohort: Pre-test, paper and pencil control group for qualitative “games” and post-test

Introduction to the exercises

The CHERMUG project has developed a number of exercises which are designed to offer you an active way to engage with research methods and statistics which will help you to learn. The exercises are aimed at students who are currently taking a beginners’ module in research methods or statistics. It can also be used as a short refresher course for more advanced students.

Altogether there are there are 8 quantitative and 3 qualitative exercises but in this session you will only do 2 of the qualitative exercises. The exercises follow a cycle in which the research process is presented as a problem-solving activity with different tasks performed at different phases of the cycle. Each exercise highlights specific aspects of the cycle from defining the research question, through data collection and data analysis to the interpretation of results phase.

The exercises that we are going to look at all concern the obesity problem in Europe. Obesity is one of the greatest public health challenges of the 21st century. The UK has the largest percentage of adults who are obese with 23% of adults obese. This is followed by the Slovak Republic and Greece. The first set of exercises concerns qualitative research.

In this session you will have the chance to carry out 2 of the 11 CHERMUG exercises. You will go through the following steps:

- First of all you will complete a questionnaire (**Demographics and information**) about your background including age, gender, experience of computer games and your views about research methods and statistics.

- Next you will practice/test your knowledge on the exercises. You should carry these out in the following order:
 - **Qualitative level 1**

 - **Qualitative level 2**

- Once you have completed these, you will complete a final questionnaire on motives, competence and your perceptions of the exercises (**Final questionnaire**)

- +
 - Finally, you may want to continue practicing with the remaining exercises.

By ticking this box I confirm that I have read and understand the information sheet, have had the opportunity to ask questions and I agree to take part in the study.





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Demographics and Information questionnaire

This short questionnaire asks you some basic information about your background. Please indicate your response by ticking the appropriate box.

10. Which university do you attend?

1	Open University of the Netherlands	<input type="checkbox"/>
2	University of the West of Scotland	<input type="checkbox"/>
3	Satakunta University of Applied Sciences	<input type="checkbox"/>
4	Universidad Complutense de Madrid	<input type="checkbox"/>
5	University of Medicine and Pharmacy of Craiova	<input type="checkbox"/>
6	Other	<input type="checkbox"/>

11. What gender are you?

1	male	<input type="checkbox"/>
2	female	<input type="checkbox"/>

12. Which of the following categories includes your age?

1	17 or younger	<input type="checkbox"/>
2	18-29	<input type="checkbox"/>
3	30-39	<input type="checkbox"/>
4	40-49	<input type="checkbox"/>
5	50-59	<input type="checkbox"/>
6	60 or older	<input type="checkbox"/>

13. Which kind of student are you?

1	Full-time undergraduate	<input type="checkbox"/>
2	Part-time undergraduate	<input type="checkbox"/>
3	Full-time postgraduate	<input type="checkbox"/>
4	Part-time postgraduate	<input type="checkbox"/>
5	Other	<input type="checkbox"/>

14. Please select the subject discipline of your studies

1	Nursing	<input type="checkbox"/>
2	Social science	<input type="checkbox"/>



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3	Health	
4	Education	
5	Learning science	
6	Other	

15. Which of the following best describes your level of expertise with research methods and statistics?

1	Student with little or no knowledge of research methods	
2	Student with at least a basic understanding of research methods	
3	Student with a good understanding of research methods	
4	Teacher	
5	Researcher	

16. Do you play computer games?

1	yes	
2	no	

17. Please rate the frequency with which you on average play computer games

1	Less than one hour per week	
2	2-4 hours a week	
3	Up to 2 hours a day	
4	More than 2 hours a day	

18. Please rate, from 1 to 7, how much you like the following kinds of computer games, where 1 means not at all and 7 means very much. Circle your answer.

<i>First person shooters. Like for example, the sagas Call of Duty (Black Ops), Borderlands, Halo or Bioshock.</i>	1	2	3	4	5	6	7
<i>Adventure games and thrillers. Examples: sagas Uncharted, Heavy Rain, Resident Evil or Assassin's Creed.</i>	1	2	3	4	5	6	7
<i>Rhythm games (singing, dancing and music). Examples: sagas Guitar Hero, Sing Star or Just Dance.</i>	1	2	3	4	5	6	7
<i>Fighting games. Examples: sagas Tekken, Mortal Kombat or Street Fighter.</i>	1	2	3	4	5	6	7
<i>Brain and knowledge testing games. Examples: Brain Training, Trivia o Brain Academy.</i>	1	2	3	4	5	6	7



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<i>Strategy games. Examples: Civilization, Age of Empires, Command and Conquer or Starcraft.</i>	1	2	3	4	5	6	7
<i>Sports and racing games. Examples: FIFA, PES, NBA Live, Gran Turismo or Need for Speed</i>	1	2	3	4	5	6	7
<i>Platformers and/or party games. Examples: Super Mario, Mario Kart, Wii Party or Wii Sports.</i>	1	2	3	4	5	6	7
<i>Massively Multiplayer Online Games. Examples: World of Warcraft, Farmville, or NeverWinter Nights.</i>	1	2	3	4	5	6	7
<i>Simple, social games (e.g. Wordfeud)</i>	1	2	3	4	5	6	7

Have you ever played a computer game as part of learning?

1	Never	
2	Once	
3	More than once	
4	not often	
5	Often	

19. Please indicate on the 5-point scale your views about research methods and statistics, where 1 means strongly disagree and 5 means strongly agree.

	1	2	3	4	5
I find research methods and statistics interesting.					
I find research methods and statistics boring.					
I really enjoy research methods and statistics.					
Learning about research methods and statistics provides me with useful skills.					
I find research methods and statistics difficult.					

20. The following questions provide a self-assessment of your perceived competence with respect to aspects of research methods and statistics. For each question, please indicate on the 5-point scale how competent you feel in that area, where 1 indicates not competent at all and 5 indicates highly competent.

		1	2	3	4	5
1	I know the main steps of a research study.					
2	I am able to identify research scenarios typical of either qualitative or quantitative research.					
3	I am able to set-up a simple research design (what, where, who, how many).					
4	I am able to define a research question and connected hypothesis.					
5	I am able to select the main variables of a study and their type.					
6	I am able to select and use common data representations such as					



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	histogram, contingency tables, box-plots.					
7	I am able to apply statistical tests such as chi-square.					
8	I am able to apply statistical tests such as the t-test.					
9	I am able to apply a coding scheme to a set of qualitative data.					
10	I am able to read the statistical output of a chi-square test.					
11	I am able to read the statistical output of a t-test.					
12	I am able to determine the significance of a chi-square test.					
13	I am able to determine the significance of a t-test.					

1. Qualitative or Quantitative?

In the first exercise we will consider the main differences between the qualitative and quantitative research approaches and practice some examples.

Exercise 1: Qualitative or Quantitative Data?

In this exercise you will see examples of data that are either qualitative or quantitative data-sets. For each data-set please indicate with a tick whether you think it is qualitative or quantitative or whether you are not sure. There are four datasets.

Q1. Dataset 1:

- Qualitative
- Quantitative
- Not sure

Eat	R	BMI	Eat	R	BMI	Eat	R	BMI	Eat	R	BMI	Eat	R	BMI	Eat	R	BMI	Eat	R	BMI									
		24.			25.			27.			27.			26.			32.			18.			22.			24.			25.
No	0		No	5		Yes	5		Yes	8		No	4		Yes	7		Yes	6		Yes	3		No	6		No	2	
		32.			24.			20.			27.			27.			32.			24.			26.			23.			26.
No	2		Yes	3		Yes	4		Yes	2		Yes	2		No	6		No	3		No	9		Yes	5		No	8	
		17.			20.			27.			30.			23.			22.			27.			27.			27.			25.
No	0		No	0		No	9		No	5		Yes	0		Yes	5		Yes	8		No	7		No	5		Yes	4	
		30.			26.			21.			29.			22.			23.			26.			21.			26.			30.
No	1		No	4		No	4		No	1		No	9		No	3		No	5		No	1		No	3		No	9	
		24.			26.			28.			28.			23.			26.			25.			26.			30.			23.
Yes	3		No	1		No	1		No	3		No	6		No	6		No	3		No	7		Yes	1		No	5	
		28.			19.			27.			22.			28.			24.			25.			30.			30.			19.
Yes	2		Yes	5		No	5		Yes	8		Yes	6		No	6		No	5		No	5		No	0		Yes	9	
		27.			28.			24.			28.			28.			34.			20.			24.			21.			23.
No	1		No	7		No	6		Yes	4		No	0		No	3		Yes	9		No	4		Yes	4		Yes	3	
		23.			23.			23.			24.			20.			24.			24.			21.			21.			25.
Yes	1		No	7		No	6		Yes	4		Yes	7		Yes	0		No	9		No	2		Yes	7		Yes	4	



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22.	26.	26.	22.	29.	23.	26.	24.	25.	28.
No 1	No 7	No 8	Yes 9	Yes 0	Yes 4	Yes 6	No 8	No 4	No 6
18.	30.	27.	23.	22.	33.	25.	29.	21.	29.
Yes 4	No 5	Yes 3	No 7	No 4	Yes 6	Yes 1	No 2	Yes 7	No 1
23.	31.	27.	31.	24.	28.	24.	28.	27.	29.
No 5	No 3	No 2	Yes 9	Yes 7	Yes 2	Yes 0	No 3	No 5	No 1
24.	28.	27.	26.	24.	17.	28.	23.	20.	24.
No 3	Yes 0	No 2	Yes 8	No 4	Yes 3	Yes 4	Yes 0	Yes 2	No 4

Q2. Dataset 2:

- Qualitative
- Quantitative
- Not sure

“At school I was always picked on for my weight. You never had friends. They never mucked around with the fat girl. You were all on your own. You learn it hurts very much.” (57 year old female)
“It wasn’t until I had my baby that I ballooned. I lost the weight, fell pregnant, put it all back on and now I just can’t move it.” (29 year old female)
“I was always on some kind of diet. The first one was Jenny Craig when I was twelve.” (28 year old female)
“I’ve been abusing my body for the last 7 years trying to figure out what to do.” (30 year old female)

Q3. Dataset 3:

- Qualitative
- Quantitative
- Not sure

“It was more the fact that I want to keep my figure now.”
“The reason I started was ‘cause my father was saying “you’re unfit you have to go” and I started going.”
“I’m a very competitive person.”
“Health and fitness number one, peace of mind number two... it’s like my hour and a half that I have to myself.”
“A lot of people who go to gym because they’re the body beautiful.... They sort of parade around you know.”

Q4. Dataset 4:

- Qualitative
- Quantitative
- Not sure

Subje	Gend		Subje	Gend		Subje	Gend		Subje	Gend		Subje	Gend	
ct	er	Choice	ct	er	Choice	ct	er	Choice	ct	er	Choice	ct	er	Choice



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1	Female	Chocolate	21	Male	Crisps	41	Female	Chocolate	61	Female	Chocolate	81	Female	Chocolate
2	Female	Chocolate	22	Male	Crisps	42	Male	Crisps	62	Male	Crisps	82	Female	Chocolate
3	Female	Chocolate	23	Male	Crisps	43	Male	Crisps	63	Female	Chocolate	83	Female	Chocolate
4	Male	Chocolate	24	Male	Chocolate	44	Male	Chocolate	64	Female	Chocolate	84	Male	Chocolate
5	Female	Chocolate	25	Male	Crisps	45	Female	Chocolate	65	Female	Crisps	85	Male	Chocolate
6	Female	Chocolate	26	Male	Chocolate	46	Male	Chocolate	66	Female	Chocolate	86	Male	Chocolate
7	Male	Crisps	27	Male	Crisps	47	Male	Crisps	67	Male	Chocolate	87	Female	Chocolate
8	Male	Chocolate	28	Female	Crisps	48	Male	Crisps	68	Female	Chocolate	88	Female	Chocolate
9	Male	Chocolate	29	Male	Crisps	49	Female	Chocolate	69	Female	Chocolate	89	Male	Chocolate
10	Male	Chocolate	30	Female	Chocolate	50	Male	Crisps	70	Male	Chocolate	90	Male	Crisps
11	Female	Crisps	31	Male	Crisps	51	Female	Chocolate	71	Female	Chocolate	91	Male	Crisps
12	Male	Chocolate	32	Male	Crisps	52	Female	Chocolate	72	Male	Chocolate	92	Female	Chocolate
13	Female	Chocolate	33	Male	Crisps	53	Female	Chocolate	73	Female	Chocolate	93	Female	Crisps
14	Female	Chocolate	34	Male	Chocolate	54	Male	Crisps	74	Female	Chocolate	94	Female	Crisps
15	Female	Chocolate	35	Male	Chocolate	55	Male	Chocolate	75	Female	Chocolate	95	Female	Chocolate
16	Male	Chocolate	36	Male	Crisps	56	Male	Chocolate	76	Female	Chocolate	96	Female	Chocolate
17	Male	Chocolate	37	Male	Crisps	57	Female	Chocolate	77	Female	Chocolate	97	Female	Chocolate
18	Female	Chocolate	38	Male	Crisps	58	Male	Chocolate	78	Female	Crisps	98	Female	Crisps
19	Female	Chocolate	39	Female	Chocolate	59	Female	Chocolate	79	Female	Chocolate	99	Male	Chocolate
20	Male	Chocolate	40	Female	Chocolate	60	Male	Chocolate	80	Male	Chocolate	100	Male	Crisps

Exercise 2: Qualitative and quantitative approaches to research



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Your next task is to identify the differences between qualitative and quantitative approaches to research taking into account different aspects, general characteristics, theoretical underpinnings, kinds of data and data analysis. Below you can see characteristics which are more typical of either a quantitative or a qualitative approach to research. Please consider each characteristic and indicate whether it is more typical of a quantitative or a qualitative approach. For each of the 28 examples, please indicate your answer by putting a tick in the appropriate box for that characteristic.

	General characteristics	quantitative	qualitative
1	More likely to ask how much? How many? How often? To what extent?		
2	More concerned with explanation of facts		
3	More concerned with theory testing		
4	More likely to ask Why? How? In what way?		
5	More concerned with interpretation of facts		
6	More concerned with theory building		
	Theoretical underpinnings	quantitative	qualitative
7	presented in numerical form and are interpreted on the basis of the statistics calculated		
8	Adopts an objective approach		
9	Adopts a deductive approach		
10	Data analysis is deductive		
11	Adopts a subjective approach		
12	Data analysis is inductive.		
13	Adopts an inductive approach		
14	Is based on a variety of underlying philosophies and traditions from a variety of different disciplines		
	Kinds of data	quantitative	qualitative
15	Deals with numbers		
16	Deals with phenomena that must be measured		
17	Data can be observed, measured and quantified		
18	Involves the study of differences between groups		
19	Deals with phenomena that cannot be measured, only experienced.		
20	Deals with descriptions		
	Data can be observed but not measured.		
	Data analysis	quantitative	qualitative
21	Data analysis involves statistical testing		
22	Involves the study of relationships between variables		



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23	Typically focuses on a few variables		
24	Examples of analysis would include chi –square, t-test, regression etc		
25	Typically identifies many themes		
26	Looks at the meaning individuals or groups ascribe to a social or human problem.		
27	Data analysis involves thematic coding		
28	Examples of analysis would include phenomenology, ethnography, and grounded theory.		

Exercise 3: Qualitative or quantitative scenarios

In the scenarios task you are given short descriptions of proposed research projects and your task is to decide whether each scenario would be best tackled via a qualitative or quantitative approach to research. Read through each scenario and then, for each scenario decide whether a qualitative or quantitative approach would be better.

Q1. Scenario 1

A community nurse is concerned about the increasingly large number of obese people in her client group. She does not know how these clients feel about being obese and problems associated with that and, therefore, cannot help them as much as she would like to. She decides that the way to improve her knowledge is to undertake a small research study in which she interviews a few of her patients to find out how they feel about being obese and their experiences of being obese.

- Qualitative**
- Quantitative**

Q2. Scenario 2

A researcher is convinced that people become morbidly obese or overweight due to some underlying reason. They suspect (He suspects) that this reason could be related to feelings of depression or low self-esteem. The researcher would like to explore this hypothesis more closely and is very interested in collecting highly confidential personal data.

- Qualitative**
- Quantitative**

Q3. Scenario 3

A researcher is interested in comparing two well know diets that have been used to lower BMI. One is the Pro-Points diet used by Weightwatchers and the other is the Atkins diet. As well as finding out which one of the diets promotes greater weight loss, the researcher is also interested in which one of the diets promotes greater well-being.

- Qualitative**
- Quantitative**



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Q4. Scenario 4

A sports centre manager was aware that a major problem with exercise programs is that participants drop out because they get bored. Two different programs were looked at (1) “body pump” and (2) “circuit training”. 140 exercisers took part in the study, 80 in the “body pump” and 60 in the “circuit training”. After ten weeks of the programs the numbers of participants who were still in the program and the number who had dropped out were assessed.

- Qualitative**
- Quantitative**

2. Qualitative exercise: Study design and coding

Introduction

In the second exercise you will learn some of the important steps that you need to follow in designing a qualitative study and performing qualitative analysis. You will consider the background to the study, the method and sampling of participants, including where to go to sample participants and the number of participants you will need. You will also look at data analysis involving coding.

The research question

The research question you are going to address is:

“What factors influence children’s food preferences and eating behaviours in the home?”

Background

This research question is based on a paper by Holsten et al (2012) which is a qualitative study of factors which influence children’s choices of food in the home environment. Consider the following scenario:

“Obesity rates in children have increased dramatically over the past thirty years, largely due to declines in children’s consumption of fruit, vegetables and low-fat dairy foods and increases in their consumption of snacks and sugar-sweetened beverages. To improve children’s diet and health and reduce obesity it is important to examine the factors which influence what children choose to eat. The majority of children’s food intake occurs at home and many fundamental dietary behaviours are established and reinforced in this setting. Previous research has identified a large number of factors that influence children’s food choices at home, such as the taste and availability of foods, hunger, food cravings, mood and parent support and the effort involved in food preparation. In the current study we examine these varied influences.”

Exercise 1. Study design

Q1. Selecting the method of data collection

What is the best way to collect data, taking into account the research question for this study? Select from the options shown below and indicate your answer with a tick.

1	Personal interview	
2	Focus groups (6-8 people)	
3	Observation	



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4	On-line survey	
5	Classroom discussion	

Q2. Selecting the participants – Where?

You would also have to select where would be the best place to go to collect the most useful data, given the research question for the study. Select from the options shown below and indicate your answer with a tick.

1	Go out in the street at the weekend and attempt to find groups of adolescents to question.	
2	Go to a local school playground and ask groups of pupils.	
3	Ask teachers in a local school to select 6-8 pupils and ask them at a special session at lunchtime.	
4	Go to a local after-school play group and ask groups of adolescents.	
5	Go to a local nightclub and attempt to get groups of adolescents to respond.	

Q3. Selecting the participants – Who and how many?

In addition you would have to select an appropriate sample, bearing in mind the research question for the study. Think about how many and which kind of people to select. Select from the options shown below and indicate your answer with a tick.

1	Any 20 groups of 6-8 willing people.	
2	Any 20 groups of 6-8 willing females.	
3	Any 10 groups of 6-8 willing males and 10 groups of 6-8 willing females.	
4	Any 4 groups of mixed males and females at junior, intermediate and senior forms (years)	
5	Any group of mixed males and females at junior, intermediate and senior forms (years)	

Exercise 2. Qualitative data coding exercise

For the qualitative analysis stage, the data are analysed and coded relative to the broader themes that they focus on.

In this exercise, you will examine how people's food preferences can be categorised in terms of higher level categories or themes. You will code a sample of the data that was collected in the study,



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concerning participants' verbal statements about their food preferences, with respect to which higher level theme it fits under best. Each item can be coded under several higher level categories but when all eight items are considered together each item has an optimal coding under a specific category. The items vary in difficulty and some include an element of ambiguity. This reflects the difficulties which can arise in real life qualitative coding, or each item of data put a tick into the box which you think best reflects how that item should be coded.

You must use each coding option once and you should have a tick for each higher level category.



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	Data	Child's food preferences	Child's prioritisation of activities	Parent presence	Time pressure for parent	Health Concerns of parent	Food attributes	Food availability	Context of time
1	"I personally consider weekend[s] more of the party time for lunch and what I mean by party time is like maybe pizzas, hot dogs, and hamburgers and maybe ribs sometimes."								
2	"I picked donuts because they are sweet."								
3	"Usually in the morning I don't have enough time to eat so I just go to school. [In order to eat breakfast] I would have to wake up early and I wake up early enough right now."								
4	"If we have more apples, then I'll just grab an apple so that there's more cookies for everybody else."								
5	"Dinner usually it								



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	depends if. . .she's [mom] gone I usually just have like a Hot Pocket or those microwavable Taquitos. . .Hot Pockets are good and they're really easy to make."								
6	"I like things that contain sugar because of the sweetness and the flavor, so I tend to go for those first just cause I want the sweetness."								
7	"I have soda rarely since my dad found out he has diabetes."								
8	"If my mom is working that night sometimes we go out because she doesn't have time to make dinner."								



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Appendix 8: SAMK Phase 3 cohort: Pre-test, paper and pencil control group for quantitative “games” and post-test

Introduction to the CHERMUG exercises

The CHERMUG project has developed a number of exercises which are designed to offer you an active way to engage with research methods and statistics which will help you to learn. The exercises are aimed at students who are currently taking a beginners' module in research methods or statistics. They can also be used as a short refresher course for more advanced students.

Altogether there are there are 8 quantitative and 3 qualitative exercises but in this session you will only do 4 of the quantitative exercises. The exercises follow a cycle in which the research process is presented as a problem-solving activity with different tasks performed at different phases of the cycle. Each exercise highlights specific aspects of the cycle from defining the research question, through data collection and data analysis to the interpretation of results phase.

The exercises that we are going to look at all concern the obesity problem in Europe. Obesity is one of the greatest public health challenges of the 21st century. The UK has the largest percentage of adults who are obese with 23% of adults obese. This is followed by the Slovak Republic and Greece. The first set of exercises concerns qualitative research.

In this session you will have the chance to carry out 4 of the 11 CHERMUG exercises. You will go through the following steps:

- First of all you will complete a questionnaire (***Demographics and information***) about your background including age, gender, experience of computer games and your views about research methods and statistics.

- Next you will practice/test your knowledge on the exercises. You should carry these out in the following order:
 - ***Quantitative Exercise 1: Gender & Reward***
 - ***Quantitative Exercise 2: Skipping meals and obesity***
 - ***Quantitative Exercise 3: Nationality and Mediterranean foods***
 - ***Quantitative Exercise 4: Type of diet and weight loss***

- Once you have completed these, you will complete a final questionnaire on motives, competence and your perceptions of the exercises (***Final questionnaire***)

- Finally, you may want to continue practicing with the remaining exercises.

All the questionnaires and exercises are accessed though the Moodle site.

By ticking this box I confirm that I have read and understand the information sheet, have had the opportunity to ask questions and I agree to take part in the study.





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Have you ever played a computer game as part of learning?

1	Never	
2	Once	
3	More than once	
4	not often	
5	Often	

21. Please indicate on the 5-point scale your views about research methods and statistics, where 1 means strongly disagree and 5 means strongly agree.

	1	2	3	4	5
I find research methods and statistics interesting.					
I find research methods and statistics boring.					
I really enjoy research methods and statistics.					
Learning about research methods and statistics provides me with useful skills.					
I find research methods and statistics difficult.					

22. The following questions provide a self-assessment of your perceived competence with respect to aspects of research methods and statistics. For each question, please indicate on the 5-point scale how competent you feel in that area, where 1 indicates not competent at all and 5 indicates highly competent.

		1	2	3	4	5
1	I know the main steps of a research study.					
2	I am able to identify research scenarios typical of either qualitative or quantitative research.					
3	I am able to set-up a simple research design (what, where, who, how many).					
4	I am able to define a research question and connected hypothesis.					
5	I am able to select the main variables of a study and their type.					
6	I am able to select and use common data representations such as histogram, contingency tables, box-plots.					
7	I am able to apply statistical tests such as chi-square.					
8	I am able to apply statistical tests such as the t-test.					
9	I am able to apply a coding scheme to a set of qualitative data.					
10	I am able to read the statistical output of a chi-square test.					
11	I am able to read the statistical output of a t-test.					



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12	I am able to determine the significance of a chi-square test.					
13	I am able to determine the significance of a t-test.					

Quantitative exercises

In the following exercises we will guide you, with the help of a number of questions, through the main steps of a realistic quantitative research study. The steps are as follows:

- Background and Objective
- Experiment design
- Data analysis & Results

Each exercise is introduced by a short scenario which provides a background to a specific study followed by a number of questions. You should indicate the correct answer with a tick. N. B. Some questions might have more than one correct answer.

Quantitative exercise 1: Gender & Reward

Background scenario

In a bigger study of diet and weight loss, male and female dieters were allowed to choose a “reward” at the weekend to encourage them in their weight loss. The reward was either a bar of chocolate or a packet of crisps. 50 male and 50 female dieters took part in the study. The dieters were asked to indicate in a food diary which reward they had selected, either a bar of chocolate or a packet of crisps.

Background and Objective

1. What are the key variables in this study? Remember there may be more than one answer.

- Gender
- Male
- Female
- Reward selected
- Chocolate
- Crisps

2. In this study what are the levels of the two variables, gender and reward selected? Remember there may be more than one answer

- Selected reward
- Chocolate
- Male
- Gender
- Crisps
- Female

3. In the study, what level of measurement is appropriate for the gender of the dieters?

- Nominal
- Ordinal
- Ratio
- Interval



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4. In the study, what level of measurement is appropriate for the reward selected?

- Nominal
- Ordinal
- Ratio
- Interval

Experiment design

5. What kind of design does this study suggest?

- an association between variables
- differences between groups

6. Now we know a bit more about the study we can formulate our hypothesis precisely. Formulate the null-hypothesis by selecting the correct THREE sentence parts. Put a tick beside the three you choose:

- There is a relationship
- There is no relationship
- between selecting crisps
- between being a female dieter
- between gender
- and the reward which was selected
- and selecting a bar of chocolate
- and the bar of chocolate which was selected

7. Which of the following raw datasets is the best one to test your data? Select from the options shown below and indicate your answer with a tick.

Dataset 1

	Gender of dieters	Choice of reward
1	male	choc
2	female	crisps
3	male	choc
4	male	choc
5	male	crisps
6	female	choc
7	female	choc
8	female	crisps
9	female	choc
10	female	choc

Dataset 2

	Gender of dieters	Choice of reward
1	male	crisps
2	male	crisps
3	male	choc
4	male	crisps
5	male	choc
6	male	crisps
7	male	choc
8	male	choc
9	male	choc
10	male	crisps

Data analysis & Results

8. Which data summary would you like to see the data represented the?

- Pie chart
- Contingency table
- Frequency distribution bar chart
- Scatter diagram
- Box-plots



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Look at the contingency table below and for each of the statements, 9 -12, say whether that statement is true or false.

Row Labels	Female	Male	Total
Chocolate	43	27	70
Crisps	7	23	30
Total	50	50	100

9. There were 200 participants in this study.

- True
- False

10. Half the participants were male and half were female.

- True
- False

11. Altogether there were more people in the sample who chose crisps than who chose chocolate.

- True
- False

12. There were more males in the sample who chose chocolate than who chose crisps.

- True
- False

13. What test statistic would you like to see?

- p-value
- Chi-square value
- None of the above

14. The critical value of chi-square for a 2 * 2 crosstab at 0.05 significance level is 3.84. The calculated chi-square value = 12:19, $p < 0.000$. Is this chi-square value significant?

- Yes
- No



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Quantitative exercise 2: Skipping meals and obesity

Background scenario

Individuals who are overweight seem less regular in their mealtimes than those who are not. In a study of eating habits a researcher examined whether 120 teenage girls regularly skipped meals. Possible responses were “yes”, “no” and “sometimes”. 60 girls who were identified as being overweight were matched for age and ethnicity with 60 normal weight girls.

Background and variables

1. In this study what are the variables? Remember there may be more than one answer.

- Age
- Gender
- Weight
- No
- Skipping meals
- Yes

2. In this study what are the levels of the variables? Remember there may be more than one answer.

- Yes
- Sometimes
- Normal weight
- Weight
- No
- Overweight

3. In this study what level of measurement is appropriate for skipping meals?

- Nominal
- Ordinal
- Interval
- Ratio

4. In this study what level of measurement is appropriate for being overweight?

- Nominal
- Ordinal
- Interval
- Ratio

Experiment design

5. Which kind of design does this study suggest?

- an association between variables
- differences between groups



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6. Formulate the null-hypothesis by selecting the correct sentence parts:

- There is no difference
- There is no relationship
- between being normal weight
- between skipping meals
- between sometimes skipping meals
- and being overweight
- and weight category
- and never skipping meals

7. Which of the following raw datasets is the best one to test your data?

- Dataset 1
- Dataset 2

Dataset 1

	Skips meals	Overweight or not	Overweight or not
1	yes	Overweight	Normal weight
2	yes	Overweight	Normal weight
3	yes	Overweight	Normal weight
4	no	Overweight	Normal weight
5	sometimes	Overweight	Normal weight
6	sometimes	Overweight	Normal weight
7	no	Overweight	Normal weight
8	sometimes	Overweight	Normal weight
9	no	Overweight	Normal weight
10	no	Overweight	Normal weight

Dataset 2

	Skips meals	Overweight or not
1	yes	Overweight
2	yes	Overweight
3	yes	Normal weight
4	no	Overweight
5	sometimes	Overweight
6	sometimes	Normal weight
7	no	Overweight
8	sometimes	Overweight
9	no	Normal weight
10	no	Normal weight



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Data analysis & Results

8. Which data summary would you like to see the data represented in?

- Contingency table
- Frequency distribution bar graph
- Box-plots

Look at the contingency table below and for each of the statements, 9 -11, say whether that statement is true or false.

	Yes	Sometimes	Do Not Skip	Total
Overweight	27	25	8	60
Normal	13	23	24	60
Total	40	48	32	120

9. Overall there were more girls who skip meals than who do not skip meals.

- True
- False

10. The least common response for normal weight girls was that they skip meals.

- True
- False

11. There were more overweight girls who never skipped meals than there were girls of a normal weight who never skip meals.

- True
- False

12. Of the two tables below, which table shows observed frequencies, table A or table B?

- Table A
- Table B



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A

Row Labels	Yes	sometimes	Do Not Skip	total
Overweight	27	25	8	60
Normal	13	23	24	60
Total	40	48	32	120

B

Row Labels	Yes	sometimes	Do not skip	total
Overweight	20	24	16	60
Normal	20	24	16	60
Total	40	48	32	120

15

13. Of the two tables above, which table shows expected frequencies, table A or table B?

- Table A
- Table B

14. Which test statistic would you like to see?

- Pearson's r
- T value
- Chi-squared value

15. The critical value of chi square for a 3*2 contingency table at the .05 level of significance for a two tailed test is 5.99. Is the chi square value below significant?

- Yes
- No

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.983 ^a	2	.002
Likelihood Ratio	13.461	2	.001
Linear-by-Linear Association	12.488	1	.000
N of Valid Cases	120		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 16.00.



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Quantitative Exercise 3: Nationality and Mediterranean foods

Background scenario

The “Mediterranean” diet traditionally eaten by Southern Europeans is rich in fruit, vegetables, beans, olive oil, nuts and fish. Recently it has been suggested that this kind of diet helps to prevent obesity. It seems likely that Northern Europeans eat fewer of these Mediterranean foods. In the current study 60 British children and 60 Spanish children were presented with a checklist of 30 Mediterranean foods and they were asked to indicate which of these foods they had eaten in the previous week. Each child was given a score from 0 to 30.

Background and variables

1. In this study what are the variables? Remember there may be more than one answer.

- Spanish children
- Nationality
- British children
- Northern Europeans
- Consumption of Mediterranean foods
- Obesity
- The checklist

2. In this study what is the independent variable? Remember there may be more than one answer.

- Spanish children
- Nationality
- British children
- Northern Europeans
- Consumption of Mediterranean foods
- Obesity
- The checklist

3. In the same study what is the dependent variable? Remember there may be more than one answer.

- Spanish children
- Nationality
- British children
- Northern Europeans
- Consumption of Mediterranean foods
- Obesity
- The checklist

4. In this study what level of measurement is appropriate for consumption of Mediterranean foods?

- Nominal
- Ordinal
- Interval
- Ratio



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5. In this study what level of measurement is appropriate for nationality?

- Nominal
- Ordinal
- Interval
- Ratio

Experiment design

6. Which kind of design does this study suggest?

- an association between variables
- differences between groups

7. Now we know a bit more about the study we can formulate our hypothesis precisely. Formulate the null-hypothesis by selecting the correct THREE sentence parts. Put a tick beside the three you choose:

- There will be a difference
- There will be no difference
- in the fruit and vegetables
- between Spanish children and British children
- between boys
- in consumption of fruit and vegetables
- in the number of Mediterranean foods consumed
- and girls

8. Which of the following raw datasets is the best one to test your data?

- Dataset 1
- Dataset 2

Dataset 1

	Nationality	Number of Mediterranean foods consumed
Participant 1	Spanish	12
Participant 2	Spanish	14
Participant 3	Spanish	23
Participant 4	Spanish	12
Participant 5	Spanish	22
Participant 6	British	21
Participant 7	British	17
Participant 8	British	14
Participant 9	British	12
Participant 10	British	18

Dataset 2

	Nationality	Number of Mediterranean foods consumed
Participant 1	Spanish	12
Participant 2	Spanish	14
Participant 3	Spanish	23
Participant 4	Spanish	12
Participant 5	Spanish	22
Participant 6	Spanish	21
Participant 7	Spanish	17
Participant 8	Spanish	14
Participant 9	Spanish	12
Participant 10	Spanish	18

Data analysis & Results

9. Which graphical representation of the data would you like to see?



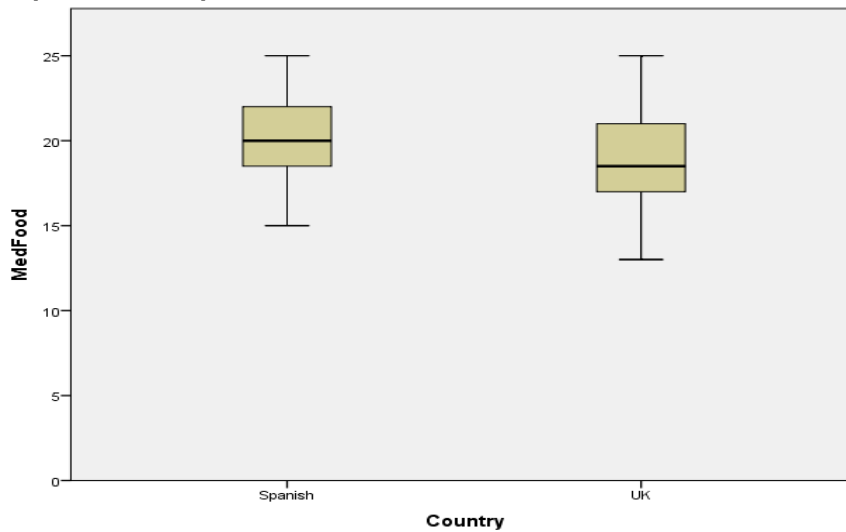
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- Pie chart
- Histogram
- Contingency table
- Box-plots

10. The boxplot suggests that the median number of Mediterranean foods consumed by Spanish children is slightly higher than the median number consumed by British children.

- True
- False

Boxplot: consumption of Mediterranean foods



11. The tables of results below show that on average Spanish children consumed 20.20 Mediterranean foods per week.

- True
- False

Group Statistics

	Country	N	Mean	Std. Deviation	Std. Error Mean
MedFood	Spanish	60	20.20	2.503	.323
	UK	60	18.83	2.781	.359

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MedFood	Equal variances assumed	.843	.360	2.829	118	.005	1.367	.483	.410	2.323
	Equal variances not assumed			2.829	116.713	.005	1.367	.483	.410	2.323

12. Overall the tables of results show that we can conclude that Spanish children did not consume significantly more Mediterranean foods per week than British children.



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- True
- False

To test the hypothesis that “There will be no differences between Spanish children and British children in the number of Mediterranean foods consumed.” which statistical test would you use?

- T test for independent samples
- Chi square
- Pearson’s r

14. Interpretation of table below. One of the following statements is true. Which one? Choose either:

- The table shows that on average British children consumed 18.83 Mediterranean foods per week.
- The table shows that on average British children consumed 2.781 Mediterranean foods per week.

Group Statistics

	Country	N	Mean	Std. Deviation	Std. Error Mean
MedFood	Spanish	60	20.20	2.503	.323
	UK	60	18.83	2.781	.359

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MedFood	Equal variances assumed	.843	.360	2.829	118	.005	1.367	.483	.410	2.323
	Equal variances not assumed			2.829	116.713	.005	1.367	.483	.410	2.323

15. Interpretation of table of results. Which of the following statements is true? Choose one:

- The significance value of .005 shows that this was a significant difference.
- The significance value of .005 shows that this was not a significant difference.



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Quantitative exercise 4: Type of diet and weight loss

Background to study

A dietician believes that the “Fat-buster” diet is better than the “Lo-carb” diet in helping her clients loose weight but she needs some evidence to support this claim. She has 30 new clients starting on the “Fat- buster” diet and 30 on the “Lo-carb” diet and she weighs them at the start of their diet and then again after 10 weeks on the diet. She then calculates the amount of weight each client has lost in kilograms over the 10 weeks.

Background and variables

1. In this study what are the variables? Select from the answers below. Remember there may be more than one answer.
 - Lo-carb diet
 - Fat-buster diet
 - Kind of diet
 - Weight at start of diet
 - Weight loss
2. In this study what is the independent variable? Remember there may be more than one answer.
 - Lo-carb diet
 - Fat-buster diet
 - Kind of diet
 - Weight at start of diet
 - Weight loss
3. In this study what is the dependent variable? Remember there may be more than one answer.
 - Lo-carb diet
 - Fat-buster diet
 - Kind of diet
 - Weight at start of diet
 - Weight loss
4. In this study what level of measurement is appropriate for kind of diet?
 - Nominal
 - Ordinal
 - Interval
 - Ratio
5. In this study what level of measurement is appropriate for weight loss?
 - Nominal
 - Ordinal
 - Interval
 - Ratio

Experiment design

6. Which kind of design does this scenario suggest?
 - an association between variables
 - differences between groups



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7. Now we know a bit more about the study we can formulate our hypothesis precisely. Formulate the null-hypothesis by selecting the correct THREE sentence parts. Put a tick beside the three you choose:

- There will be a difference
- There is no difference
- between the Fat-buster and the Lo-carb diets
- between the Fat buster diet
- in weight loss
- and the Lo-carb diet

8. Which of the following raw datasets is the best one to test your data?

- Dataset 1
- Dataset 2

Dataset 1

	Kind of diet	Weight loss after 10 weeks
1	Fat-buster	+2.5kg
2	Fat-buster	0kg
3	Fat-buster	+0.8kg
4	Fat-buster	+2.1kg
5	Fat-buster	-1.2kg
6	Lo-carb	-0.2kg
7	Lo-carb	-1.4kg
8	Lo-carb	+2.1kg
9	Lo-carb	-1.2kg
10	Lo-carb	+3.4kg

Dataset 2

	Kind of diet	Kind of diet	Weight loss after 10 weeks
1	Fat-buster	Lo-carb	+2.5kg
2	Fat-buster	Lo-carb	0kg
3	Fat-buster	Lo-carb	+0.8kg
4	Fat-buster	Lo-carb	+2.1kg
5	Fat-buster	Lo-carb	-1.2kg
6	Fat-buster	Lo-carb	-0.2kg
7	Fat-buster	Lo-carb	-1.4kg
8	Fat-buster	Lo-carb	+2.1kg
9	Fat-buster	Lo-carb	-1.2kg
10	Fat-buster	Lo-carb	+3.4kg

Data analysis & Results

9. Which graphical representation of the data would you like to see?

- Frequency distribution histogram
- Scatter diagram
- Box-plots



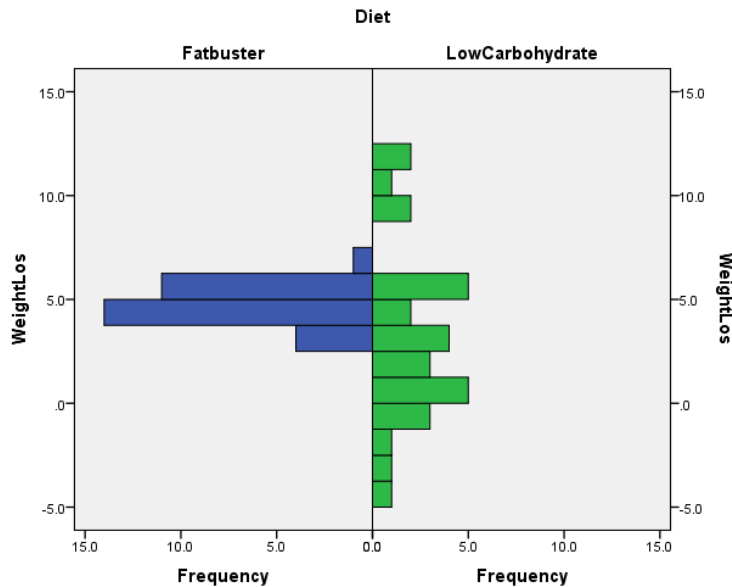
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10. The histogram below shows that there was more variability in weight loss for participants on the Fat-buster diet than the Lo-carb diet.

- True
- False



11. The table of results below shows that the mean weight lost per week by those on the Lo-carb diet was 4.303 kgs.

- True
- False

Group Statistics

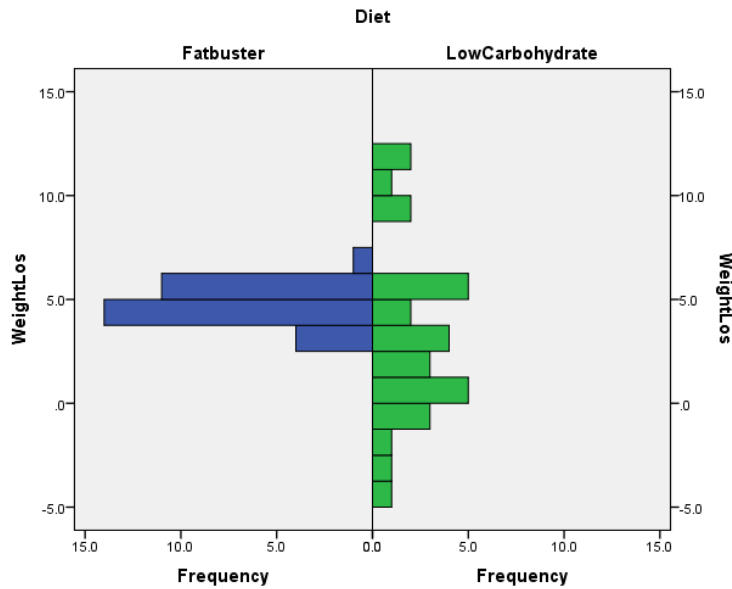
Diet		N	Mean	Std. Deviation	Std. Error Mean
WeightLos	Fatbuster	30	4.847	.9428	.1721
	LowCarbohydrate	30	3.217	4.3030	.7856

12. The significance value of the t-test (below) shows that we should reject the null hypothesis.

- True
- False



13. The histogram below shows that the median weight loss was higher for participants on the Fat-buster diet than for those on the Lo-carb diet.



- True
- False

13. The histogram above shows that there was more variability in weight loss for participants on the Fat-buster diet than the Lo-carb diet.

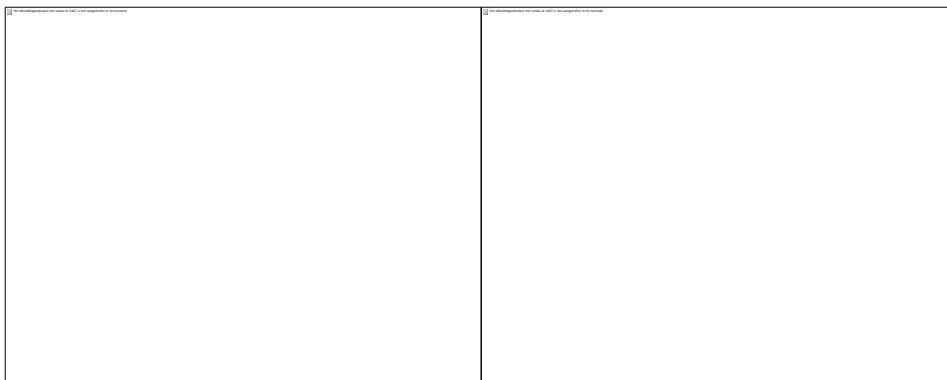
- True
- False

15. Choose the boxplot which matches the histogram above.

- Boxplot A
- Boxplot B

Boxplot A

Boxplot B





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16. To test the hypothesis that “There will be no significant difference between the Lo carb and the Fat-buster diets in the amount of weight lost.” which statistical test should we use?

- Independent samples t test
- Repeated measures t test
- Mann Whitney U test

17. The values in the table of 4.303 and .9428 show that:

- Those on the Lo-carb diet lost more weight than those on the Fat-buster diet.
- Those on the Lo-carb diet showed greater variability in weight loss than those on the Fat-buster diet.

18. The tables shows that on average those on the Fat-buster diet lost more weight than those on the Lo-carb diet.

- True
- False

Group Statistics

Diet		N	Mean	Std. Deviation	Std. Error Mean
WeightLos	Fatbuster	30	4.847	.9428	.1721
	LowCarbohydrate	30	3.217	4.3030	.7856

Final questionnaire

1. Views about activities

We are interested in your feelings about the activities that you have taken part in today. Consider each of the following statements and indicate your agreement with the statement where 1 means completely disagree, 3 is neither agree or disagree and 5 is completely agree.

		1	2	3	4	5
1	I enjoyed doing this activity very much.					
2	I think I was pretty good at this activity.					
3	I believe this activity could be of some value to me.					
4	I think this is an important activity.					
5	This activity was fun to do.					
6	I think I did pretty well at this activity, compared to other students.					
7	I think that doing this activity is useful for getting to know my strong and weak points in research methods.					
8	I really learned something while doing this activity.					
9	I thought this was a boring activity.					
10	After working at this activity for a while, I felt pretty competent.					
11	I think this is important to do because it can help me to test my research skills in realistic scenarios.					
12	The activity motivated me to learn about research methods.					
13	This activity did not hold my attention at all.					
14	I am satisfied with my performance at this task.					



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15	I would be willing to do this again because it has some value to me.					
16	This activity was at the correct level of difficulty.					
17	I would describe this activity as very interesting.					
18	I was pretty skilled at this activity.					
19	I think doing this activity could help me to practice my research methods skills.					
20	I would like to be offered more activities like these to support my learning.					
21	I thought this activity was quite enjoyable.					
22	This was an activity that I couldn't do very well.					
23	I believe doing this activity could be beneficial to me.					
24	I would rather learn about research methods in another way.					
25	While I was doing this activity, I was thinking about how much I enjoyed it.					
26	This is a nice way to learn about research methods.					

Please indicate on the 5-point scale your views about research methods and statistics, where 1 means strongly disagree and 5 means strongly agree.

		1	2	3	4	5
1	I find research methods and statistics interesting.					
2	I find research methods and statistics boring.					
3	I really enjoy research methods and statistics.					
4	Learning about research methods and statistics provides me with useful skills.					
5	I find research methods and statistics difficult.					

2. The following questions provide a self-assessment of your perceived competence with respect to aspects of research methods and statistics. For each question, please indicate on the 5-point scale how competent you feel in that area, where 1 indicates not competent at all and 5 indicates highly competent.

		1	2	3	4	5
1	I know the main steps of a research study.					
2	I am able to identify research scenarios typical of either qualitative or quantitative research.					
3	I am able to set-up a simple research design (what, where, who, how many).					
4	I am able to define a research question and connected hypothesis.					
5	I am able to select the main variables of a study and their type.					
6	I am able to select and use common data representations such as histogram, contingency tables, box-plots.					
7	I am able to apply statistical tests such as chi-square.					



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8	I am able to apply statistical tests such as the t-test.					
9	I am able to apply a coding scheme to a set of qualitative data.					
10	I am able to read the statistical output of a chi-square test.					
11	I am able to read the statistical output of a t-test.					
12	I am able to determine the significance of a chi-square test.					
13	I am able to determine the significance of a t-test.					



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