Tutor guide for the

CHERMUG quantitative and qualitative games

The CHERMUG project website can be found at www.CHERMUG.eu
Introduction to the CHERMUG quantitative and qualitative games
The CHERMUG quantitative and qualitative games are two online digital games which have been designed to provide activities to support students as they learn about research methods and statistics. The two separate CHERMUG games reflect the two main approaches (quantitative and qualitative) which have been developed to carrying out research. The primary objective of the CHERMUG games is to expose students to research challenges and to foster debriefing and discussion sessions to support them in learning. The games provide support for students in acquiring the skills of a research scientist by simulating the sequence of activities carried out in tackling research questions and providing practice in applying some of the basic methodological and statistical constructs that students typically find difficult. Acquiring expertise in research methods and statistics is core knowledge and competence for students in many different disciplines, forming an important component of the higher level thinking skills required to tackle the ill-defined problems that we face in the 21st century. This guide provides a brief account of the games and how they might be used in learning.

The CHERMUG videos

In addition to this tutor guide, four videos have been prepared which describe the CHERMUG games and explain how you might use the games in teaching research methods and statistics. The links are as follows:

1. CHERMUG Games Introduction  http://youtu.be/BDc1bUEjHbc
4. How to use CHERMUG games  http://youtu.be/GVbO2zgqnm0w
The use of serious games in learning

There is growing evidence in the literature that serious games can provide an effective tool to support learning (Joint Information Systems Committee, JISC, 2007). Serious games have been developed in many different content areas, especially in health (Arnab, Dunwell and Debattista, 2013) and business (Ben-Zvi and Carton, 2007). Since games are typically highly engaging, it was thought that a game-based approach might help to provide an effective means of engaging students in understanding research methods, an area which many students find dry, abstract and boring. The game based approach also fits well with modern theories of effective learning which propose that learning is more effective where students are carrying out realistic activities which are situated in a real world context, where feedback is provided at an appropriate level, where there is an element of exploration and where the problem is seen from a number of different perspectives. These active approaches to teaching are increasingly advocated for learning about research methods and statistics and a games-based approach would seem to provide such an approach.

The focus of the quantitative and qualitative games

Both the quantitative and qualitative games can be viewed from the perspective of the research methods cycle which characterises the research process as a cyclical problem solving process with different activities and tasks which are carried out at different stages in the cycle. Each game highlights specific aspects of the cycle. The qualitative game focuses on the differences between qualitative and quantitative approaches, choosing an appropriate method for collecting data and an appropriate sample to address the research question and carrying out qualitative coding. The quantitative game focuses on the many inter-connected issues related to formulating and testing a hypothesis, including operationalizing variables, specifying the study design, summarising and analysing data and interpreting results.

Target audience for the games The games are primarily aimed at nursing and social science students but the content area (obesity) is of general interest and the game could be used by students in other subject disciplines such as science, business or information technology.
The quantitative and qualitative games are targeted at beginners, students who are new to research methods and statistics. The games would be most useful for those who are taking an introductory module on research methods and have some basic knowledge of the area.

**Platform and IT skills** To play the games, students require access to a networked computer since the games are online. The games can also be played on tablets or mobile devices, although, as with other mobile games and apps, use on a small screen may be difficult for those with poorer vision. Players connect to the game via the CHERMUG website which can be found at [www.CHERMUG.eu](http://www.CHERMUG.eu). The games require no IT skills on the part of the tutor or the students, beyond being able to open a web-page in a browser.

**Content** The games are designed to illustrate that both qualitative and quantitative approaches to research can be used to tackle the same topic. The topic selected for consideration in the game is the obesity epidemic and factors which are relevant to obesity. During the 20th century obesity became an increasing problem in Europe and across the world and in 1997 it was recognized as a global epidemic by the World Health Organization (WHO) (Caballero, 2007). WHO estimated that by 2005 at least 400 million adults across the world were obese. The factors impacting on obesity are complex and have been studied using both quantitative and qualitative approaches to research. The topic of obesity is of general interest to nursing and social science students (as well as students more generally) and is a topic which many people already have some personal interest in and knowledge of and find easy to relate to.

A pre-game activity accompanies the quantitative and qualitative games (see Appendix 1: Brainstorming Activity 1). This activity was designed as an “ice breaker” to suggest to students that they already know quite a lot about the factors which are relevant in studying obesity. The game mirrors to some extent the initial processes of choosing a research area and “narrowing” down the area to a more specific research question.
Generic skills While the game illustrates the acquisition of quantitative and qualitative skills through the content area of obesity, it is important that tutors should point out to students that the research skills that they are acquiring are generic skills which apply independently of content.
The CHERMUG Qualitative game

Background
The CHERMUG qualitative game is an online digital game which can be found at the CHERMUG website (www.CHERMUG.eu). The CHERMUG qualitative game aims to support students as they learn about the qualitative approach to research methods. The qualitative approach is suitable as an exploratory approach for investigating a phenomenon when not much is known about that phenomenon or to provide a broad understanding of a complex problem. The qualitative approach seeks to generate new knowledge and new ideas, rather than testing existing knowledge or ideas. The qualitative approach to research is increasingly recognized as providing valuable detailed information that the quantitative approach cannot. In the CHERMUG qualitative game the phenomenon under investigation is the obesity epidemic. Qualitative research would be appropriate for exploring the obesity epidemic for example in understanding why people eat the foods they do, how they feel about their bodies and constraints they might experience in losing weight.

There are many issues which need to be considered when carrying out qualitative research and the qualitative game focuses on just a few of these. The qualitative game aims
To consolidate students’ understanding of the main characteristics of the qualitative approach and differences between the qualitative and quantitative approaches.

- To allow students to practice designing a qualitative study
- To allow students to practice qualitative coding using realistic examples

**Narrative** The qualitative game uses a narrative concerning a student who is acquiring expertise in qualitative research and who is challenged with being accepted into a research group. The game informs the student that this process has three steps: 1) being prepared for a qualitative test 2) passing the qualitative test and 3) demonstrating his/her skills in qualitative design and analysis by preparing to submit an academic paper. Using a narrative to link the 3 levels increases the "game" feel and should increase student motivation and engagement to take part in the activities.

**Game levels** The game is structured into three levels of difficulty which correspond to the 3 stages of the narrative. Level 1 is the introductory level where students develop and demonstrate their understanding of key differences between quantitative and qualitative approaches to research. Levels 2 and 3 focus on specific research studies. Players are presented with a specific research question and an account of the background to a study and they are required to carry out exercises in which they have to select an appropriate data collection method and suitable sample of participants to take part in the proposed study. They are also required to carry out some simple qualitative coding. At level 2 players are given supportive feedback about their selections and coding as they proceed through the activities. At level 3 students are encouraged to adopt a more exploratory approach and they only receive feedback at the end of the game when they have taken part in all the activities.

**Introduction to the game**
The qualitative game starts with the narrative explaining the aim of the qualitative game, i.e. that they should become a successful member of a research team doing research on obesity and that, to do this, he/she has to acquire and demonstrate their expertise in qualitative research. Players are then presented with a few screens showing evidence from different sources about the global obesity epidemic. Sources include official statistics from the World Health Organisation as well as stories about obesity in popular newspapers.
The learning objectives for level 1 are to allow players to develop and demonstrate an understanding of the main differences between quantitative and qualitative approaches to research with respect to philosophical underpinnings, methods and approaches, kinds of data and data analysis. There are three mini-games at level 1 and these are designed to assess students’ understanding of key differences between quantitative and qualitative approaches to research.

- Mini-game 1: Qualitative or quantitative data?
- Mini-game 2: Contrasting qualitative and quantitative research
- Mini-game 3: Qualitative or quantitative scenarios

**Mini-game 1: Qualitative or quantitative data?**
In the first mini-game players are presented with examples of raw data in different formats and are simply asked to decide whether a specific data-set is qualitative or quantitative. This allows players to practice their understanding of the essential differences between qualitative and quantitative data. Figures 1 shows an example of a qualitative dataset.

![Figure 1: example of a qualitative data set](Image)

**Mini-game 2: Contrasting qualitative and quantitative approaches**
The next mini-game is a matching game, which allows players to demonstrate their understanding of the differences between qualitative and quantitative approaches to research in four different areas: general characteristics, theoretical underpinnings, kinds of data and data analysis. Players are presented with characteristics which are typical of either the qualitative or quantitative approach and...
they have to match the characteristics to the correct research approach. Figure 2 shows the interface for a player trying to match descriptions of theoretical underpinnings to the correct category of research approach. When players are finished the matching task, they must check the accuracy of their responses. Characteristics which have been categorised correctly will turn green, while those which are incorrect will turn red and flash. The player cannot continue playing the game until all characteristics have been matched correctly (i.e. all have turned green).

![Figure 2: Contrasting qualitative and quantitative approaches](image)

**Mini-game 3: Qualitative and quantitative scenarios**

In this mini-game players are presented with a number of scenarios which provide short descriptions of the background to a research study. The player’s task is to decide whether each scenario suggests that a qualitative or quantitative approach would be more suitable in tackling the scenario described.

**Level 2: Passing the qualitative test**

**Research question and background to study**

At level 2 players learn about some of the important steps in carrying out qualitative research and the order in which these occur by actually experiencing these. Players are presented with a short description of the background to a study along with a research question. The level 2 game 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.

There are two mini-games at level 2. The game and associated learning objectives for level 2 are:

- **Mini-game 1: to master study design**
  - by selecting an appropriate method for collecting data
  - by choosing where to go to collect the data
and by choosing a suitable sample of participants to address the specific research question

- Mini-game 2: to master qualitative coding

**Mini-game 1: Study design**
The choice of appropriate methods and samples is an important issue in designing a qualitative study and this mini-game highlights the importance of carefully considering the method of data collection and the size, quality and representativeness of the sample. Players are asked to design their study by selecting the most appropriate method for collecting data from several options provided (see Figure 3).

![Figure 3: Options available in selecting an appropriate method to gather data](image)

Players are then asked to choose where they would go to collect their data as well as selecting a suitable sample, i.e. who they would choose to provide the data. In each case players are provided with a number of different options. At level 2, following each selection, players receive immediate feedback about their choices and they are given the chance to play the game again to improve their performance. This allows players to learn about which choices are best for the current study.

**Mini-game 2: Coding qualitative data**
Coding of data is a key activity in qualitative analysis. In the qualitative coding mini-game, players are provided with data in the form of participants’ verbal statements about a specific topic (in this case food preferences) and a number of pre-defined thematic categories. The goal for the players is to correctly classify each statement according to the appropriate higher level thematic category. Figure 4 shows an example item of data to be coded at the bottom of the screen, along with the higher level thematic categories (child, parent, food and context of time) to which players have to assign each item of data at the top of the screen. Players are given eight data items to code and there are eight
separate coding categories. 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 is intended to reflect difficulties which can arise in real life qualitative coding. Players can change their coding as they go through the exercise by cancelling their initial choice and selecting a new choice. Once they have coded all eight data items to their satisfaction, players can check the accuracy of their responses. Correctly coded items turn green, while incorrectly coded items turn red. If a player has coded an item under, for example, three different higher level categories this will show up as incorrect since, although the item might fit under the different categories, there is an optimal coding for each item. This could of course lead to discussion out of the game about how to code ambiguous items. Players are required to code all data items correctly before they can advance. On completion of the coding exercise, players are given feedback about their scores for all level 2 activities.

**Figure 4: Screenshot showing a data item and coding categories for the level 2 qualitative game**

It is important to note that in real-life qualitative coding the researcher typically has to develop the thematic categories him/her-self and tutors should point this out to students. In addition, there is usually more than one item of data coded under each higher level category. However the current activity is intended to provide an easier coding exercise for students since they do not have to generate the higher level themes themselves. The game thus provides beginners with practice in qualitative coding allowing them to experience some of the difficulties and ambiguities which can occur but in an easier, more manageable context. To extend the value of the coding exercise and provide a more detailed understanding of the process of qualitative research, it would be useful to refer students to the paper which the game was based on after they have played the game.

Level 3: Dealing with Qualitative Analysis

Level 3 follows a similar sequence of activities as level 2 in that players are presented with a research question and a short background to a study and they are required to choose an appropriate data collection method and suitable sample from the choices provided as well as carrying out qualitative coding. However level 3 differs from level 2 in that there is less support for players at the different stages and level 3 is more exploratory and game-like. For example, rather than being presented with choices about the method, place and participants in a specific order, players have to choose the order in which to tackle these themselves. If players choose to carry out data analysis before they specify the study design, they will be told that they have no data yet. Players are not provided with feedback until they have completed the study design and coding mini-games. In this sense level 3 reproduces the process of sending a paper to a journal (or carrying out a student project) where feedback is not provided at the different stages. The level 3 game is based on a paper by McCabe et al (2007) which is a qualitative study of statements made by mothers about their children’s diet and exercise habits and appearance which might influence children’s body image.

The level 3 coding mini-game is a bigger coding exercise than level 2. Players’ selections at the design stage have an impact on the number of data items and coding categories that they are presented with at the coding stage. For example if a player selects an unsuitable method for collecting data, he/she will be presented with fewer items to code at the coding stage and this will impact on his/her overall score. Similarly if a player selects a sample which only includes boys, he/she will only be presented with data from boys to code and again this will reduce their score. Players who make optimal choices at the design stage will be presented with a maximum of 24 data items leading to a possible maximum score. There are 12 coding categories if both male and female participants are chosen as. If players make very poor choices at the design stage they will be informed that, due to these poor choices, the data that they will get in the coding exercise will be of very poor quality and will be very difficult to code.

Feedback is provided by the "journal reviewer" only once all activities have been completed.

Of course there are many issues relating to qualitative research that the qualitative game does not address. For example different approaches to qualitative research such as grounded theory, phenomenology and ethnography are not discussed in detail. These should of course be discussed out of the game.
The CHERMUG quantitative game

The CHERMUG quantitative game is an online digital game which can be found at http://playgen.com/chermug.

The quantitative approach to research
The quantitative approach to research is the traditional experimental approach typically associated with science, sometimes called the hypothetico-deductive approach. The researcher starts with something he or she knows a little about and wants to explore further. Quantitative researchers formulate hypotheses about relationships between variables or differences between groups which they test by collecting relevant empirical data. Quantitative data is always numerical and frequently involves statistical testing. Quantitative researchers must ensure that the methods they use to collect data are objective and not biased.
Introduction to the quantitative game
As any textbook on research methods and statistics shows there are many different issues which need to be considered in carrying out quantitative research and many of these could be addressed in a game on quantitative methods. However, since the central focus of quantitative research is on hypothesis testing, the CHERMUG quantitative game centres around hypothesis testing. In the game the player is presented with a series of examples each focusing on a different research question related to obesity, such as food preferences, the effectiveness of different diets and body image. Each example starts with a short scenario describing that study, providing a rationale for the study, background information about the research question, such as the relevant variables and how they were measured and information about the study participants. The game takes the player through a sequence of activities which helps them to address the inter-related issues in tackling the research question and formulating and testing a research hypothesis, such as what the variables are and how they are operationalised, what the hypothesis is, selection and interpretation of appropriate graphical representations of data and selection and interpretation of relevant statistical tests. These activities reflect the sequence of operations required in carrying out a research project.

Research methods experts are aware of the varied issues that must be considered and how they are interconnected, but for novices it is much more difficult to appreciate how an issue such as how a variable is measured is related to the choice of statistical test. The quantitative examples are intended to help novices make these connections by having to consider for each example the complex, inter-related knowledge which must be considered in formulating and testing a hypothesis.

Examples in the quantitative game
There are many different research designs (and related statistical tests) which are available to quantitative researchers. Two which are frequently taught on introductory courses on research methods and statistics are the relationship between nominal variables (and the associated chi square test) and differences between independent groups (and the associated independent samples t-test). All examples which are currently in the quantitative game are based on these two different kinds of study design are currently the quantitative game includes five chi-square and three t-test examples as
described below. The examples are named according to the variables that are being examined and the names of the examples do not reveal to the players whether a particular example requires chi square or t-test, since this is one of the things that players have to work out during the game. The examples are increasingly difficult as the player progresses to the next example. For example chi square scenarios 1, 2 and 3 are 2*2 chi squares, while examples 4 and 5 are 3*2 chi squares. The game could be extended to include more examples as well as different kinds of statistical test.

Chi square examples

Scenario 1: Gender and reward

Scenario 2: Exercise program and drop out

Scenario 3: Media consumption and obesity

Scenario 4: Skipping meals and obesity

Scenario 5: Nationality and body image

T-test examples

Scenario 1: Nationality and Mediterranean foods

Scenario 2: Gender and protein consumption

Scenario 3: Type of diet and weight loss

The sequence of activities in the quantitative game

Players are presented with a short scenario (see figure 5) which sets the scene for the proposed study, providing a rationale for the study, information about the relevant variables and how they were measured and information about the participants. Tell the students that the scenario remains available to be accessed at any point while that example is being executed, by clicking on “ready” so that players do not have to rely on memory.
Having read through the scenario players work through a sequence of activities covering the issues described below. The activities are presented mainly via multiple choice style questions. They are presented in the same order with slight variations depending on whether the study design reflects a relationship between variables or difference between groups design.

1. **Identification of variables**: On the basis of the information presented in the study scenario, players identify the key variables for the study from a number of possible options presented.

2. **Identification of independent and dependent variables**: For the t-test examples, players identify firstly the independent and then the dependent variables, again from a number of possible options presented.

3. **Levels of variables**: For the chi-square examples, players state the levels of each variable from a number of possible options presented.

4. **Level of measurement**: Players decide which level of measurement is appropriate for each variable. For one variable this decision is implemented through a hangman game. For the other variable this is implemented via a multiple choice question.

5. **Select design**: Players have to decide whether the design suggested in the study is experimental or correlational, via a multiple choice question.

6. **Formulate the null hypothesis**: In this drag and drop exercise players have to formulate the null hypothesis for the study by selecting three separate clauses to make a sentence, such as (There is no difference) (between males and females) (in foods selected).
7. **Identify the correct raw data set:** From a choice of two possible data-sets, players select the data-set which is most appropriate to test the hypothesis. Each of the data-sets contains a representative sample of 10 data-points (see figure 6).

![Figure 6 Selection of correct data-set](image)

8. **Identify correct data summaries:** Players are required to select which tabular or graphical representation is most appropriate for summarising and representing the data for that example.

9. **Interpret graphs, tables and SPSS output:** In the chi-square examples, players are presented with a contingency table and nine true/false questions relating to the interpretation of that contingency table. In the t-test examples, the nine Tic Tac Toe questions are more varied and refer to histograms, box plots and SPSS output.

10. **Identify/interpret correct statistical test:** In the chi-square examples, players are given a number of exercises to do interpreting the SPSS output.

**Game mechanics for the quantitative game**
Most of the game activities are presented in a multiple choice question-based format with two or more possible answers (See Figure 7). Feedback is provided about whether the player’s response is correct, along with corrective feedback when an incorrect answer is given.
Figure 6: Multiple choice activities for the selecting variables.

Other game mechanisms are also included to vary the activities. One of the “levels of measurement” questions is implemented via a hangman game mechanism (See figure 7). Players are required to input the correct level of measurement by typing in the appropriate letters.

Figure 7: Hangman mechanism for selecting levels of measurement

The hypothesis testing activity is implemented via a drag and drop mechanism presented in three parts (see Figure 8): firstly the statement of no significant relationship or difference, secondly a clause relating to the selection of the first (independent) variable and thirdly a clause relating to the selection of the second (dependent) variable.
Questions about the interpretation of the graphical and tabular data and SPSS output were implemented via a Tic Tac Toe mechanism (see Figure 9) where players progress if they answer three questions in a row correctly (horizontally, vertically or diagonally).

The CHERMUG quantitative game does not include an explicit narrative in the way that the CHERMUG qualitative game does, but the implicit narrative is the acquisition of methodological and statistical expertise and this is supported by recognition of achievements and scoring along the way.
Uses of the CHERMUG quantitative and qualitative games in teaching

While both the quantitative and qualitative games could be played by anyone, they are designed to be of most use to students who are currently studying an introductory research methods module. Tutors will have differing aims in using the CHERMUG quantitative and qualitative games depending on the focus of their modules. The games could provide support for students on different kinds of introductory module, such as a basic introduction to research methods prior to getting students to carry out their own research, or a critical analysis module where the focus is more on acquiring skills to critique published research. The games would also be useful for revision of basic methodological and statistical concepts.

Laboratory based activity Both games have been designed to be played during a tutor-led laboratory session, where each game would each fit comfortably into a one hour session. If the game were to be played by students on their own, each player would require access to a computer with internet access.

Practice at home The games could also be played by students alone at home as a computer-based exercise to practice methodological and statistical concepts learned in class.

Revision The games could be used by students for revision of basic methods and statistics concepts for example prior to embarking on a research project.

Learning a new method Many students (and academic staff) are more skilled in the use of one of the approaches to research, quantitative or qualitative and the game could help such individuals to acquire expertise with the method that they are less familiar with.

Working alone or in groups The games have been designed to be used by students working on their own, but they could also both be played by students working in groups of two or three. It seems likely that this is especially appropriate for the qualitative game where students can discuss the selection of methods and samples and coding. Working in groups can help students to appreciate the ambiguity and subjectivity of qualitative coding since fellow students might suggest that items of data might be coded differently. This helps students to understand that coding is not always straightforward.
Many students have greater expertise in either quantitative or qualitative research and the game could help them to acquire expertise in the method which they are less familiar with.

**Order of play** The games can be played in either order, that is starting with the qualitative game and then the quantitative game or vice versa. However, since level 1 of the qualitative game covers differences between qualitative and quantitative methods, it may be useful to start with this game. The pre-game activities have been found to provide effective means of introducing research methods. The brainstorming activity highlights to players that they do know something about relevant variables.

**Student guides** In addition to this tutor guide, student guides are also available providing basic guidance for students about the games.

**Videos** A number of videos have been prepared to show tutors how students might use the game. These can be found at:

2. [http://youtu.be/cB-JS4wntd0](http://youtu.be/cB-JS4wntd0) (What are CHERMUG games)
4. [http://youtu.be/GVbO2zqm0w](http://youtu.be/GVbO2zqm0w) (How to use CHERMUG games)

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**References**


**Appendix 1: Pre-game brainstorming activity**

This activity is intended to be carried out as a class activity before students play the online games, although students could take part in the activity on their own if playing the game online. In this activity you will be introduced to the idea that in investigating many research topics you are already familiar with issues which might be related to this topic. The topic which we are going to look at here is obesity. We are all concerned about our health, weight and appearance but in western societies we are already experiencing increasing numbers of people who have problems with their weight and in the UK for example it is said that 25% of people are already obese (REF). There are many factors which impact on obesity, such as the kinds of foods that we eat and whether we take exercise. In this activity you are going to think about variables which might impact on obesity.

Working in teams or with a partner (or on your own) you should write down as many ideas as you can about factors that you think have an impact on people’s weight making them more likely to become obese. You have ten minutes to do this. You have ten minutes to write down as many ideas as you can (time students).

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Grouping your ideas

Hopefully in the brainstorming session in activity 1 you came up with a number of ideas about factors which you thought might contribute in some way to the predicted obesity epidemic in 2045. This activity suggests that the reasons for obesity are complex and multifaceted. Research aims to try and unravel some of this complexity. One way in which we can do this is to see whether some of the ideas that you generated are linked in any way. For example you might have identified “Five a day”, “food preferences”, “kinds of food eaten”, “availability of food” as different factors, but we might say that
they come under a higher level factor such as “dietary and food habits and behaviours”. Similarly “diabetes”, “anorexia”, “bulimia”, “depression” and “stress” might be categorised as “abnormal eating behaviours”.

Narrowing down activity: Selection of your top five variables that impact on obesity

It is also useful to try and identify which of the ideas that you generated you think are the most important in terms of their impact on obesity. So now take the ideas that you generated while brainstorming and list your top five, the five ideas that you think are most likely to impact on obesity and consequently the ideas that you think researchers would be better to focus on in explaining obesity. Write them down on the list below from 1-5.

• 1
• 2
• 3
• 4
• 5

While these activities are not completely typical of how researchers approach research they do illustrate that for many subject areas that we might look at you already have some idea of factors which might be influential and that you have an intuition about which factors might be important. Of course you might be wrong!

The literature review

The next step for someone who is actually going to do research in the area would be to refine his/her intuitions by look at the existing literature in the area to provide a more rigorous assessment of what is already known in the area.