Comparative Analysis of Research Methodologies Applied to a Research Topic on Digital Game

Based Learning (DGBL) as a Teaching Intervention

by

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Abstract

This paper will explore, compare and analyze potential research methodologies which could be applied to a research topic on Digital Game Based Learning (DGBL) as a new teaching intervention at the Digital Communication Department in Houston Community College. Each section will begin with a description of the research type followed by what a researcher needs to observe or consider for the design or methodology selected. A final section on the strengths and weaknesses of each research type prior to the conclusion will also be included.

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Introduction

The Digital Communication Department (DCD) at the Houston Community College would like to explore the effects of Digital Game Based Learning (DGBL) methods applied to courses taught in the department. Currently only traditional lecture style methods are used in all classrooms. Research studies would involve observing and analyzing if the new teaching intervention would help improve student engagement, performance and bridge retention gaps in design courses. Hence, there is a need to study, explore and know how each research design and methodologies is applicable to the research goals and objectives.

Ravid (2005) states that research should not be confined to one paradigm of study. Also, "It is the type of question that needs answering that will ALWAYS dictate the appropriate type of study--it will NEVER always be one type or another--it will always depend. (Fitzgerald, 2006)" A researcher must study and explore the possibilities of which design method can best support data findings to the research topic and problem. This paper will focus on the discussion of various research methodologies applicable to the research topic of DGBL intervention. The definition and techniques of each method and design approach will first be described followed by further exploration, comparison and analysis for the research topic on DGBL intervention. Examples of different variable types required for the methodology or design type will also be discussed. This is followed by a section on the strengths and weaknesses for the various design methods and a conclusion.

The four components of research methods which will be covered consist of the following: (a) quantitative (b) qualitative, (c) mixed methods, and (d) action research. Along with each of these major research methods, sub-sections which include other designs (See Appendix A) will also be presented with different scenarios and research questions.

Quantitative Research Methods

Quantitative design utilizes the collection and analyzing of numerical data to help understand cause and effect phenomena, correlational and comparison of relationships, and current conditions. Often times this type of research is specific, unbiased and objective as researchers are not closely attached to the study environment (Creswell, 2005; Gay & Airasian, 2003; Ravid, 2005). Instruments for collecting data may include questionnaires, surveys, and test scores. Statistical methods and techniques are then used for describing, organizing, calculating, analyzing and interpreting the collected numerical data (Ravid, 2005). Descriptive information is then presented in a narrative form supplemented with the use of charts and figures.

The quantitative research process usually begins with a hypothesis which is a tentative prediction or forecast of the research finding results where data collected from different variables are analyzed and compared for relationships. This type of research providing evidence to support result findings for the hypothesis is also known as deductive based research method. Deductive means that the general reasoning begins with a strict prediction which is later developed and supported by data findings (Gay & Airasian, 2003).

An example of a hypothesis for DGBL research scenario could be, "Digital game base learning methods can help improve student performance and retention in cognitive learning." Quantitative research involves the collection of numerical data tabulated with statistical calculations to help support the prediction. Rationale of the relationship of the variables (definition for variables will be explained later) supporting the hypothesis must also be included in a literature review section. Past research documentation can also be used to help support the theoretical framework for the hypothesis. However, research findings can sometimes indicate null hypothesis situation. In this case, the statement would be, "Digital game based learning

methods (independent variable) did not show any student performance and retention (dependant variables) in cognitive learning." There was no relationship between both variables.

Prior to discussing about the various quantitative research designs it is important to understand the concept of variables as well as the use of measurements which is applicable for each variable type. Variable is defined as a measured data or characteristic which can vary, having more than one level while a constant has only one value level. An example of variable is instruction types used in an experiment (more than one level – traditional versus interactive) while the constant is the application of only one instruction type (participants are subjected to the same background) (Bellini, Fitzgerald & Rumrill, 1999). The researcher must also know which form of scale measurement (nominal, ordinal, interval or ratio) used by the variable is appropriate for the various forms of statistical testing and analysis (Ravid, 2005).

Independent variable is the manipulated treatment while dependant is the outcome of the treatment (Gay & Airasian, 2003). For example, the method of DGBL instructional approach is the manipulated independent variable which bears an effect, resultant change or influences (cause) student achievement and retention. The results function as dependant variables. Test and retention scores are dependant on the treatment type – a new instructional approach. Ordinal (ranking) scale of measurement can be obtained from graded test scores in drawing techniques, problem solving, design terminology, concept application, and final projects. Retention could be categorized or measured with a nominal scale approach (1=student continued to next level; 2= student dropped out of program).

If a researcher would like to investigate how the outcome of the DGBL intervention affects other dependant variables which are predictive based, other forms of research designs depending on the research question/s that needs to be implemented such as: (a) descriptive (b)

experimental, (c) correlational and (d) causal comparative. The use of variable and measurement type will also differ for each research design approach.

Descriptive Research Design

Descriptive research utilizes numerical data collected from observations and interviews where the researchers study the topic from their perception (Gay & Airasian, 2003, Fitzgerald, 2006). Gall, Gall and Borg (2003), states that descriptive research involves the process of very careful account of an educational phenomenon. This is a non experimental design because it does not include any treatment or controlled group used to study a phenomenon (frequency of events) of sampled population which exists in a certain time frame (Fitzgerald, 2006).

A descriptive research project in DGBL studies may involve the following. The researcher may want to find out final achievement exam scores of first year students enrolled in the design courses from another college or university who has utilized gaming methods for teaching comparing it to traditional teaching methods in the year of 2005. No variables are manipulated as the researcher needed to study a phenomenon that is the effects of gaming teaching methods in another context or environment setting. This may help with documenting preliminary observations and research procedure prior to conducting a formal research process at DCD and is not involved with direct treatment on variables.

Experimental Design

This type of research design involves the comparisons of sample groups where a choice of treatment or intervention is given to the groups. Participants can be selected randomly from a population group. The independent variable (IV) is one where it is being manipulated while the dependant variable is the variable where the effect of the manipulated IV is observed.

There are three types of experimental designs: (a) pre-experimental, (b) quasi-experimental and (c) true experimental. Fitzgerald (2006) states that the key features which determine the design type is dependant on whether there is a random selection (RS) and random assignment (RA) process, variable manipulation (VM) and the presence of a control group (C) (See Appendix A & C).

Example of a pre-experimental design study is a one shot case study. The researcher is only interested in finding out pre and post test scores of an exam. The study does not employ control groups; neither does it focus on examination of extraneous variables (variables which interfere with the study). Hence, the study is said to have low internal validity and is considered a weak design. Validity is dependant upon the degree to which data results which can offer justifiable and meaningful interpretation (Creswell, 2005; Ravid, 2005). A DGBL project researcher may want to run post test of exams to examine the effects of gaming as instructional methods on students. The researcher did not bother to find out about whether the students had prior gaming or computer experience. Results from students without computer experience may differ from students with computer experience. This can therefore interfere with the study results.

Quasi-experiments offer better control over pre-experimental design studies. A researcher may create comparison groups with a possibility of different backgrounds in quasi-experimental design prior to the start of a study. This type of study also lacks the use of random selection and random assignment. Hence, it can cause threats to internal validity as well as existing extraneous variables (Ravid, 2005; Trochim, 2002). Finally the study involves the manipulation of variables and use of control groups (See Appendix D, Fitzgerald 4 Key Design Features). As an example in the DGBL scenario, the researcher runs the testing on a whole class with different computer

experiences without applying random selection or assignment. However, the inclusion of a control groups (no treatment given) with traditional methods are used as comparisons.

True experimental design utilizes the application of random activity (Ravid, 2005; Trochim, 2002). Random selection (RS) and assignment (RA) for control groups and experimental (treatment) groups with manipulated variables are set up (See Appendix D, Fitzgerald 4 Key Design Features). A researcher may select either pretest-posttest, or post-test only for the treatment group depending on the situation. This is the strongest design method compared to pre-experimental and quasi-experimental designs.

At the same time, internal and external validity threats can occur. The treatment process is conducted to see if the dependant variable is affected. Results are compared with those who were not treated. Also, establishment of cause and effect between independent and dependant variables are tested and observed. This kind of study could also be used for testing theories (Creswell, 2005).

A true experimental design approach for running a research testing the effectiveness of DGBL methods (independent variable) on students at DCD would work well if the researcher utilizes both treatment groups as well as controlled groups. Random samples will be selected from the population of 200 first semester design students at DCD. Samples for the control groups can consist of students subjected to traditional teaching methods. Lectures and step by step hands on tutorials will be given followed by graded assignments for projects. Test and quizzes will be administered to test the student's knowledge on the subject matter. Students will be given final projects where they will be tested on problem solving skills and design application.

The treatment group will be subjected to the new teaching approach. Final exam scores will be collected and compared with control samples. The scores should reflect the outcome

measure (dependant variable) for the testing. Statistical methods will be used to view the quantitative differences during the testing. In this scenario, only post test methods can be used on the treatment group to view outcome scores for the testing since students are entry level students to the subject matter (See Appendix E, Table 1E).

Extraneous variables which influence participant selection and procedure (dependant variable) in experimental designs are controlled. One of the ways which researchers can avoid extraneous variables which might affect study outcomes is to make sure that the study groups have similar backgrounds (Ravid, 2005). Also, the application of random assignment helps control extraneous variables, and it is normally done before the experiment begins. Random assignment equates groups and distributes variability between groups and conditions. Other control procedure included the use of pretest and posttest as well as covariates (Creswell, 2005).

Extraneous variables which can occur in the DGBL study as stated earlier may include students with a lot of computer experience, little or no experience. These prior experience factors cannot be controlled, therefore can affect the results for the study. Students with computer experience who may be comfortable when subjected DGBL environment may like the teaching approach and hence do well with the program. Meanwhile non-computer experience students may struggle with not only the technology but also try to understand how the DGBL module works. Results may show that the module intervention for teaching was not effective. Hence the researcher must make sure of such factors which can affect the research process. A more controlled group having similar backgrounds for the treatment should consist of only students with at least 3 years computer experience can be set up. Alternatively, a questionnaire or testing on computer experiences can be conducted prior to the treatment to help create the controlled group of participants for the experiment.

When extraneous variables are observed and controlled by the researcher, this can support high internal validity for the experimental study. A very high internal validity can cause a low external validity. Studies with results of high external validity can be generalized and used in other groups and settings (Ravid, 2005). The tight control of only running testing on students with only computer experience limits the scope for the study group type. Hence, high internal validity results of the study at DCD may work for only the department but not for general group type (very little or non experienced computer population).

Correlation Design Studies

This is the study on the observation of relationship patterns. In correlational research designs, researchers investigate findings through the use of correlation statistical testing to help describe and measure the degree of association or relationship between two or more variables (Creswell, 2005). This is also used in descriptive research where exploration results of cause and effect (phenomena) are studied (Fitzgerald, 2006). The researcher utilizes variables known as predictor variables to help determine a prediction of a correlational observation. With the use of statistics, results of coefficient relations are analyzed and presented in the form of graphs and diagrams indicating relationships of the criterion variables for the study. Statistical analysis used in finding out on the association of the two scores may indicate one of the following: (a) positive or negative direction, (b) linear or non-linear form, and (c) degree and strength of the coefficient size (Creswell, 2005). A researcher also needs to know that in cases where there is a high degree of relationship between variables there could be a third causing factor which needs to be determined (Gay & Airasian, 2003). Samples of positive-negative and non relational correlational charts (scattergrams) can be found in Appendix B, Figure 1.

A correlational study question in a DGBL scenario may comprise of the following, "What is the relationship between ages and final exam scores in students enrolled in a design course using game-based approach as a teaching method at the Digital Communication Department, Houston Community College?" The quantitative ratio or interval measurement final exam scores achieved related to the category of student ages can be used for the research analysis. If findings show a negative correlation result (performance scores on y-axis; student ages on x-axis), the scattergram chart will indicate that as the ages increase, final exam scores go down (See Appendix C, Figure 1). One could infer that the game based approach method did not work as effectively for older students as it would for the younger age students. In a negative correlation, "an increase in one variable is associated with a decrease in the other variable" (Ravid, 2005, p.98.).

Causal Comparative (Ex Post Facto) Design

The purpose is to study the cause and effect of non manipulated variables in situations which have already happened. The study involves the observing the effect (dependant variables) from the cause (independent variables).

If a researcher uses *ex post facto* design in a DGBL scenario, the researcher can find out if there is a difference in achievement scores (measurement is interval based) using digital game-based approach as teaching methods for design students who have digital gaming experience versus design students who do not have digital gaming experience. The researcher will then need to select student samples from the population of graphic design majors enrolled in the Digital Communication Department. The non-manipulative independent variable, also known as the "naturally formed groups" consist of two groups of students with and without digital gaming experiences. One cannot force or change student experiences (the incident has already

happened), hence it is non manipulative. The dependant variable will be data which are measured through achievement scores.

Evaluation Design

Evaluative research often times take place in a natural real world environment or setting. It is the program, practice, activity or policy that is being reviewed or evaluated for its effectiveness. Random selection, random assignment, variable manipulation and control groups are seldom used in qualitative based designs (See Appendix C, Fitzgerald 4 Key Design Features).

Sometimes evaluative designs can be used in collaboration with other design methods. An example of such phenomena is the study about the effects of a new intervention of teaching on students' progress and motivation levels. Example of an evaluative research question design can comprise of the following, "What is the difference in the implementation of digital game based learning methods of students' motivation and achievement scores as opposed to traditional lecture methods in the year of 2005 graphic design students at the Digital Communication Department?" The purpose is to study the outcome of a certain intervention of teaching method and its effects on student learning and motivational level in 2005. The researcher gets to study the differences in outcome effects as compared to the traditional lecture teaching methods. The manipulated variable is digital game based teaching methods while the non-manipulated variable consists of traditional lecture based (non-manipulated) measurements. Though this study is evaluative based, it bears elements of an experimental design where variables are manipulated.

Qualitative Research

Qualitative research, emergent in nature or inductive based involves in an exploratory process where the focus is to seek understanding of some kind of social setting or educational

phenomena. Research cases may be studied through interactive questioning via in depth interviews, recorded observations, media (audio and video) recordings and field notes. Description of reflective findings is presented in a thick and rich narrative form (Fitzgerald, 2006). Gathered data from interviews and observations are studied from the participant's perspective. The researcher describes, analyzes and codes the wordings for themes (Creswell, 2005; Gay & Airasian, 2003; Ravid, 2005). Data in the form of analyzed patterns and themes are reviewed for qualitative analysis (Trochim, 2002). The researcher must be able to draw the reader into the frame of reference where the reader can relate to. In addition, the literature review section should contain theoretical information which relates to the research question. These explorations, measured and analyzed observations can eventually turn into theoretical conclusions for a particular phenomena (Trochim, 2002).

The sampling procedure is purposeful selection where the participants are selected because the researcher believes that information provided by the participants can offer insight to the research study (Johnson & Christenson, 2004). Attention to ethical requirements for human subjects and consent consideration along with limitations of the research must be included during the research process (Gay & Airasian, 2003). Participants must be well informed about the nature of the study and should be given the opportunity to withdraw from the study after it has started (Creswell, 2005; Ravid, 2005).

Trochim (2003) offers several guidelines which may be helpful for a researcher who wishes to use qualitative methods for research. For example, in a DGBL study scenario, the first question is, "Is the researcher's goal or purpose to generate new cognitive theories related to gaming approaches of learning and teaching?" Next, the researcher needs to ask, "Does the research topic and study call for deeper understanding of issues such as drawn interest levels for

gaming environments?" Third, "Is the researcher willing to give up detail for thematic

generalization during data summary and analysis?" Qualitative research can offer rich data

information which sometimes can end up being compromised. And finally, "Is there funding,

time and labor support for conducting the research?" The Digital Communication Department is

small and may lack the budget for the DGBL research. Running qualitative methods can be very

time consuming. The researcher must consider such factors prior planning the study.

Designs in qualitative methods may focus on one of the following approaches: (a) case

studies, (b) ethnographic, and (d) grounded theory. Again, rationale must be provided by the

researcher to particular selection of a design approach.

Case Studies

The research process for case study design approach focuses on participants' active

involvement. The participants' descriptive and explanatory knowledge on the research topic is

important to the study. The researcher needs also to have a theoretical framework to support the

research design. Additional data resources such as historical records and documentation, physical

artifacts and observations can be used for case studies.

A group of participants are selected for the study. In the DGBL case research study, a

community of digital gaming participants may be asked to share their experiences as a gamer.

For example, this study will be conducted on students at the Digital Communication Department

(DCD) who has been actively involved in playing a well known computer strategy game called

WarCraft. The focus of the research question may consist of the following, "Why are DCD

students who are actively involved in the computer strategy Warcraft games so addicted to the

game?" The researcher may be interested in finding out why the students are drawn to the game.

This qualitative study will be based on questionnaires, interviews and studied observations of

students playing the game. The study does not manipulate or control any variables. Each recorded experience via studied observations and interviews should provide rich descriptive data to understanding about in depth experiences and interest level for the game.

Prior to conducting the case study, additional research data such as historical information, anatomy and technical terms used in the games as well as design procedure about how the game was created may be helpful for the researcher. It would be applicable if the researcher utilizes words or terms which the participant could identify with in the research questions. As a result this can build a richer and productive interview session.

Ethnographic Design

This a study based on the behavior observations of cultural groups. A culture can be defined as "a civilization at a particular time and place" (Word Web, 2003). This design is most likely not applicable to DGBL design studies if the studies has no cultural base or focus intentions. However, one may consider the Digital Gaming society as a culture in itself. In this case the researcher will have to support and explain how this fits ethnographic definition for a cultural research design.

Grounded Theory

Research is based on a common phenomenon observed which can lead to the discovery or emergent of a new theory. A new theory can emerged from data collected and observed closely from this type of qualitative studies. Existing theories in literature may be used during the supporting, validation and refuting process for the new theories (Creswell, 2005).

Digital gaming is growing rapidly. A report from the Nesta Lab Research Center by Kirriemuir & McFarlane (2004), states that computers games today have become growing part of our culture which is affecting the industry and market. "People of all ages, but most visibly

children, play these games, often dedicating long periods of time in total concentration…" (Kirriemuir & McFarlang, 2004). Today many colleges and universities are implementing game design as one of the degree plans in their curriculum. The training and corporate industry is also looking into gaming methods as training strategies. A researcher for the DGBL study may want to find out what new theoretical implication which is causing the process of change. Will a new theory emerge from the observational findings during the research interactivity and coding process?

<div align="center">Mixed Methods</div>

Sometimes researchers use data collected from combined methods of both qualitative and quantitative studies to help explain and support the understanding to their research problem. The mixed method research is a phase of a research type which can build on top of another research type. For example, qualitative research data can be used initially to help get and idea of the situation which as a result can help with finding the instrument type which would best fit into the quantitative research. Or, a qualitative follow up of a quantitative research can help with detailed information of a certain phenomenon (Creswell, 2005). This type of research requires that the researcher is well verse with presenting the results from both methodologies (See Appendix A). Also additional time and effort is required to collecting and analyzing data from both research types.

Mix method approach would work well for DGBL studies because the researcher is able to apply both deductive and inductive methods to help support multiple forms of data findings where one method is not applicable. For example if the researcher would like to know and explore in depth the feelings of what goes on while the participant is involved in gaming activities, a qualitative approach would open doors for additional in depth questioning. At the

same time the researcher is able to observe the behavior and expression of participants. From the narrative answers, the researcher can utilize the data build questions for quantitative research purposes.

On the other hand, if a researcher utilizes quantitative data to find out about effects on motivational attitudes from the participants, the researcher can further explore the specifics of what is motivating the participants. This can be done via qualitative questionnaires or surveys in the form of personalized interviews.

<div align="center">Action Research</div>

Action research is a cyclic process of researching change, where action (change for improvement) and research (from understanding and knowledge) can be applied at the same time (Dick, 2002). According to Mills, action research is a systematic inquiry conducted by educators in their institution where data is collected and studies with a goal to help ("action taken") improve the teaching or learning environment (as cited in Creswell, 2005). The instructors, principle, dean or counselors of the school are involved in the research.

There are two types of action research: (a) emancipatory and (b) participatory. Emancipatory action research relates more to society or political type issues such as liberating individuals while participatory action research (PAR) involves with applied action which is much practical in an educational environment (Gay & Airasian, 2003). Action research design methods do not follow a linear pattern but instead is a dynamic process of action, reflection with data collection and back to the action procedure again. The purpose of action research is to better the lives of participants (Creswell, 2005). Participants could involve students, administrative staff or faculty members.

Action research in an educational environment, stated by Calhoun (2002) "can change the social system in schools and other education organizations so that continual formal learning is both expected and supported" (as cited in Merrill, 2004). In participatory action research (PAR), Park (1993) indicated that researched data comes from "real problems" situations that need change within the community setting. Knowledge is learned and immediately put to action. The community has a voice or freedom to speak and share their concerns. This allows the opportunity for community or lifestyle improvement, thus allowing change to occur. Through the "action" of action research cyclic process, the goal of problem solving can be achieved (Park, 1993).

For example in a DGBL study, the instructor can be involved in the research process ("takes action") as a lead researcher who implements the new teaching strategy in the first semester. The research problem has been identified in a DGBL scenario. DCD instructors are concerned with students' low retention and poor performance and would like to see the problem solved. In an action research plan scenario, a faculty member of DCD can function as the researcher. Other faculty members and staff can also participate and form part of the research team.

The research team felt that a new intervention of teaching should be implemented. Everyone gets involved in the study. Combined methods of quantitative and qualitative designs can be used (See Appendix A, Figure 1). Quantitative data used tends to be a descriptive level only (Gay & Airasian, 2003). Both faculty and students from the DCD community participate in the new intervention for teaching and learning. As soon as the approach is implemented, faculty members in DCD can help with recording the observations in their classrooms. Personal experiences about the intervention can be discussed and shared. This is a dynamic process with a self reflective research where faculty members (research team) will evaluate DCD's and faculty

practices, collect and discuss data, making necessary adjustment to research questions where applicable. Results are analyzed for improvement where necessary. The process is then repeated again (cyclic process) the following semesters with the applied changes over a period of time until the problem is solved.

<div align="center">Strengths and Weaknesses of the Research Methods</div>

As discussed above there are many research designs available to a researcher. A researcher has to consider the step by step methods involved in each of the selected design. In addition to understand the techniques and strategies involved, the researcher also needs to know the strength and weaknesses of each approach. The following section will offer another discussion of the strengths and weaknesses of design methods a researcher will encounter for a research study (See Appendix F, Table F1: Summary Analysis and Comparisons of Strengths & Weaknesses in Qualitative, Quantitative, Mixed Methods & Action Research Studies).

Quantitative Methods

Strengths. Factual research findings presented can be applied generally to different situations because it is objective approach. It can be applied well for identifying trends in a community (Gall, Gall & Borg, 2003 p.472).

When selecting a quantitative design such as correlational type studies, it permits the researcher to use of large numbers of variables for analyzing relationships in a single study. Also, the visual use of charts can effectively supported description can provide information on the degree relationship between variables (Gall et al, 2003).

Weaknesses. Once a plan is set for quantitative studies, it is very difficult for the researcher to change the design. Hence the researcher must plan well prior to the start of quantitative type studies.

There is a need for a quantitative researcher to have expertise knowledge and resource skills such as understanding, applying and explaining statistical methods and procedures and instrument type to the selected research design. A researcher who is weak or struggles with math may be at a disadvantage. Without a concrete understanding of their functionality, collected data could be miscalculated and data analysis can be misinterpreted. As a result, this can render a poor descriptive explanation for the research study and findings.

In true experimental type designs, which is considered one of the most reliable design methods requires the use of random selection and assignments control and treatment groups. Without a good population number for participant selection and assignments, the researcher cannot conduct the study even if the question calls for true experimental design.

Also, there is a need for skillful understanding and application about the different types of validity and careful observance how to set up experimental groups for treatment. The researcher needs to watch for extraneous and moderating variables which could affect the reliability of the result findings.

Qualitative Methods

Strengths. The researcher has control over the study and can probe for additional and exact details where needed, making the study more of an in depth and dynamic approach. In the example of an educational setting, qualitative research allows the researcher and participants to be closer knitted together, hence can be helpful for more reliable research findings. It allows the participant to have a voice in opinion based questions.

Because of the emergent property in case study designs, it allows the researcher to explore the opportunity to explore unusual phenomena by creating new research questions and data-collection methods. (Gall et al, 2003).

Weaknesses. The requirement of writing skills is needed. A researcher working on qualitative methods in the study of DGBL intervention must be well equipped with handling narrative reports particularly in complex phenomena. Qualitative type research requires well written description for explaining the supporting data. Gall et al (2003) stated that the process of writing the research report would require high skills and can be labor intensive. That serves as a challenge if the researcher is not a good writer or does not make an effort and time to ensure that the explanation is "rich" enough. The audience must be able to understand clearly the interpretation or research data presented by the researcher.

Next is the issue of biasness. Since the researcher is in control of the research study where it can be influenced by the researcher's perception, biasness can take place. Examples are (a) during personal interview sessions such as asking questions which may lead the participant to a certain conclusion or (b) interpretations during comparisons of data analysis. Also, a researcher must pay close attention to ethical consideration while making any judgment or assumptions during data findings or interpretation.

Time factor and interviewing skills is often times a concern for qualitative time research. An enormous amount of time is needed to conduct qualitative research. The process involves writing research questions to be used for interviews. The researcher needs prepare informed consent letters pertaining to information about the purpose and details of the research study and set up for an appointment time to meet with participants at their convenience. Where ethical procedures are mandated additional time is needed to file permission from the Institutional Review Board (IRB) to conduct personal interviews (human subjects). The interview process itself can take a good amount of time as well as skills. Sometimes researchers have to cover the

identity of the studied subject or community due to ethical constrains. This may affect the narrative quality of the research report.

After the collection of data, a considerable amount of time is need to analyze and compare results for similar themes. This can lead to another issue where the generalization of research findings may not be applicable to other settings. Research findings in special case studies may be applicable to a certain community but not another (Gall et al, 2003).

Mixed Methods

Strengths. A researcher can tap into the strengths of both research listed above which can help with the research study. The extensive combination of visual charts, numerical data formats along with rich narratives can be valuable to the research study. It is particularly useful when one research design is not enough to offer supporting insights to the study. For example, the use of close ended questionnaires can provide precise information (quantitative based) while open ended questionnaires can offer detailed information (qualitative based) from the participant.

Weaknesses. The mixed deductive and inductive approach requires that the researcher is well equipped with knowledge, techniques and skills for both research types. The researcher also needs understanding of how each method work or build on each other to create an effective mix-method research study.

Additional time and effort is also required for collecting and analyzing data from both research types. This can also end up being a cost factor for the research project.

Action Research

Strengths. The key here is action gets done. One of the advantages of action research is the fact that the community is given the power to solve problems, thus is able to set up their own research base.

Weaknesses. Action research is time consuming. Members involved in the research plan must be willing to spend time with the process. Additional effort and time is needed to understand about research methodology in cases where the members are not familiar with the research process.

One of the key points about action research is that members of the community have the freedom to speak for themselves. The voice of freedom can be informative to the research of problem issues. On the other hand it can cause conflicts between individuals or groups within the community. The researcher must be aware of ethical issues which may arise from such situations.

The nature of PAR is based on community control. Hagey (1997) indicated that this can be a problem where the researcher who is not knowledgeable enough about the community's historical, political or social background is the facilitator for the project. This can lead to misinterpretation of data that can harm the community. However, Hagey (1997) mentioned that often times, recognition of the research base is put off. Excuses included members' incompetence to run the research base, or sometimes blaming social or political conflicts. This can take away the community's rights or ownership. Again this is another ethical concern which can develop in participatory action research situations.

Conclusion

Before selecting a research design, the researcher must note that it is the research topic and questions which will function as a guide to the design selection. Once the design is selected, it will function like the blueprint for meeting the requirements supporting the research objectives. At the same time the approach must also work for the audience or study population. The researcher must also review the list of strengths and weaknesses for the various research methods

to compare and review the limitations and possibilities of type of research methods such as expertise, skills time, budgetary and labor resources.

A DGBL researcher at the Digital Communication Department (DCD), Houston Community College may utilize this paper as a guide which covered an overview of the 4 major design methods and additional sub design categories. Discussions on how the different questions would work with each design selection as well as considerations (where applicable) for hypothesis, variable types, measurement and validity were covered. A comparison and analysis of strengths and weaknesses has been included to help prepare the researcher for potential concerns which to be avoided prior to the start of the research process. Time spent on reviewing and comparing how each design methodology can help with the research topic and questions will eventually result in a more productive and successful DGBL research project.

Appendix A

Diagram Summary of the 4 Main Research Methods

Figure 1. Diagram showing Research Design Summary and adaptation from Fitzgerald (2006) guide to Key Features in Research Design (See Appendix C). Orange dotted lines show how the combination of designs can constitute another design method.
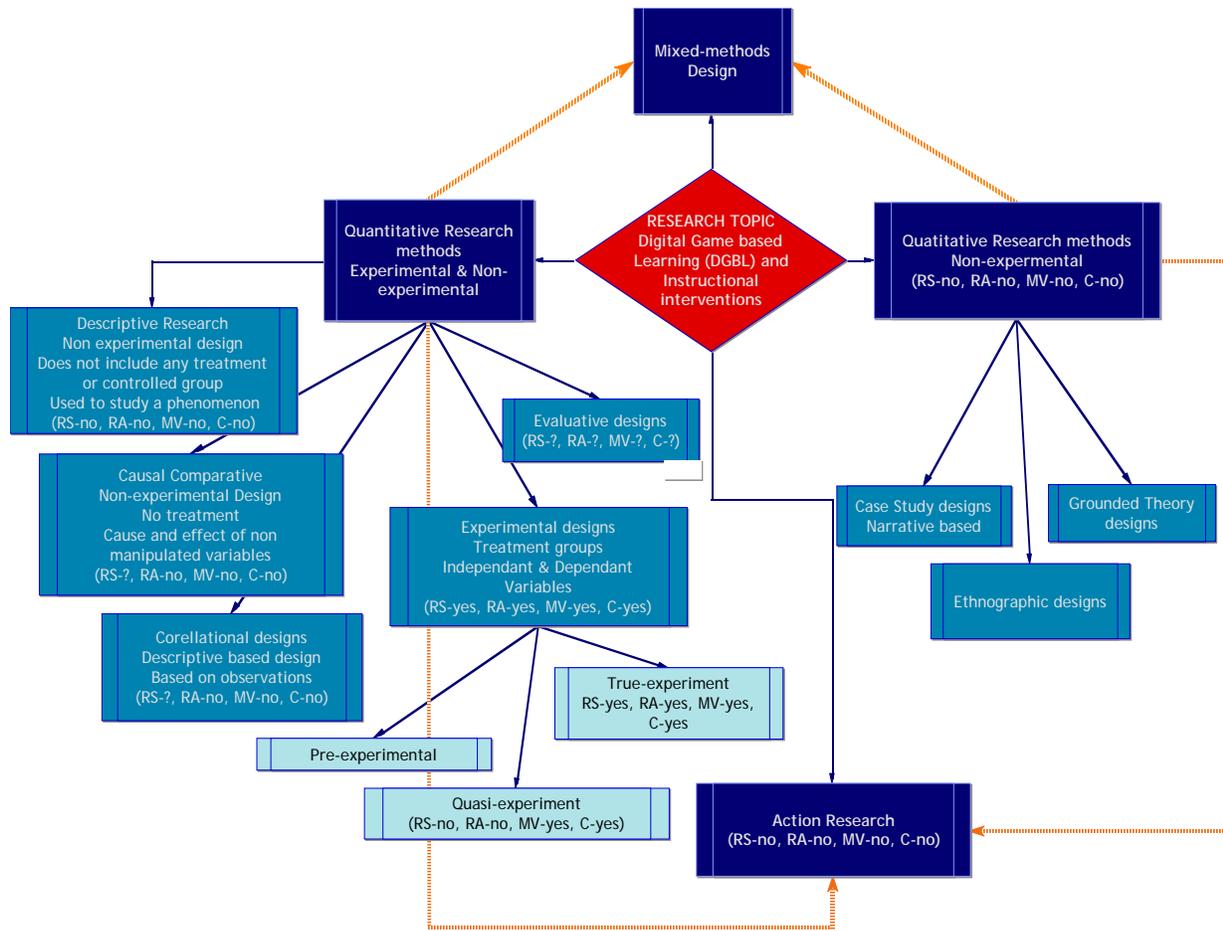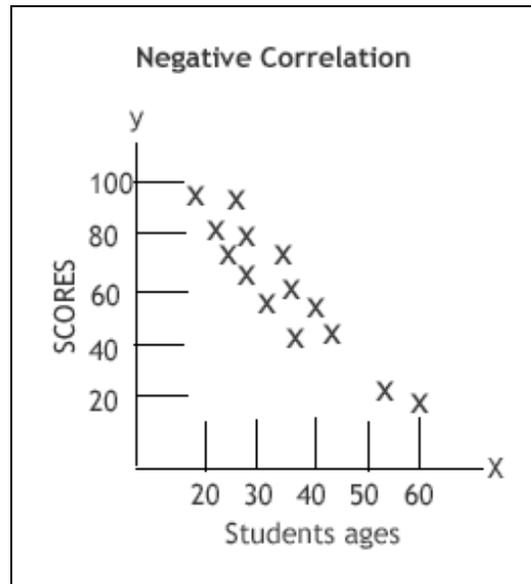
Appendix B

Examples of Correlation Diagrams (Creswell, 2005)

A. Positive Linear (r=+.75)

B. Negative Linear (r=-.68)

C. No Correlation (r=.00)
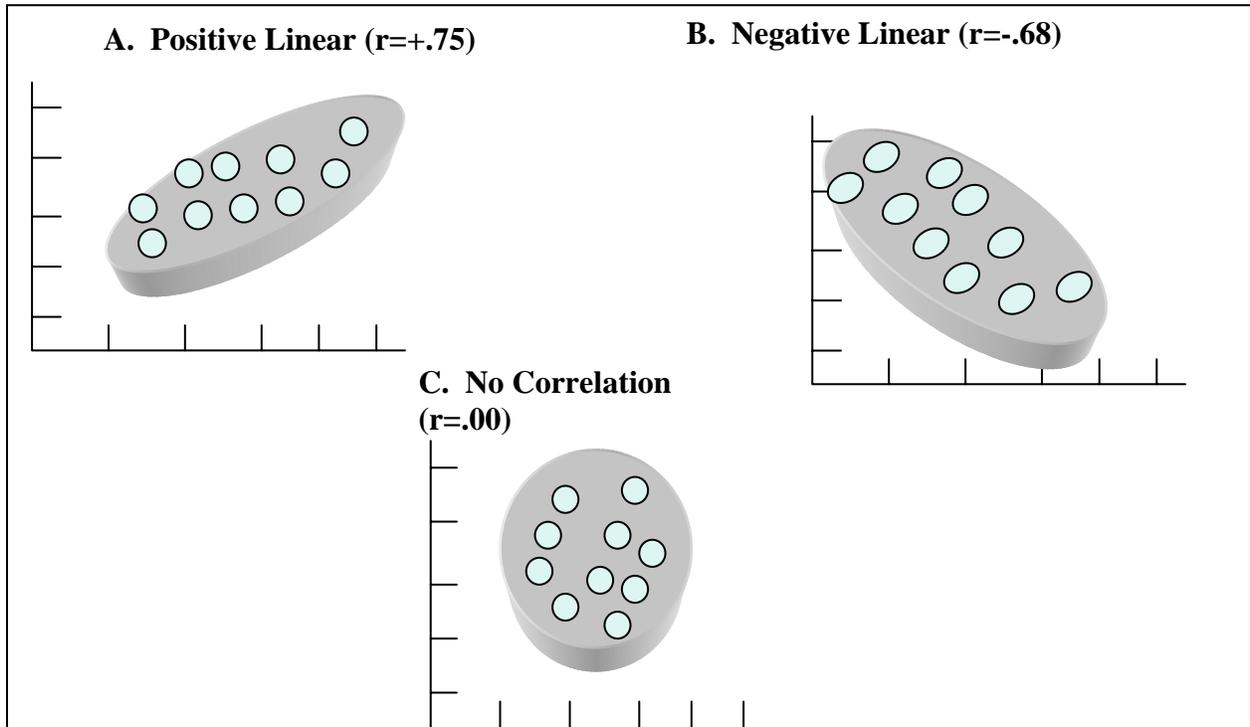
Appendix C

Negative DGBL Correlation Sample

Figure 1. Scattergram showing an example of a negative correlation between the students' ages and exam scores in a DGBL study scenario.

Appendix D

Fitzgerald 4 Key Design Features (Fitzgerald, 2006)

1. Random subject selection [RS]. (Was it a random process or not?)

2. Random subject assignment [RA]. (Was it random or not?)

3. Variable manipulation [VM]. (Was there variables being manipulated or not?)

4. Control group included [C]. (Was there a control group for comparison?)

    Breakdown of which designs have these elements (A "?" implies it may be used on

    occasion):

    a. Experimental: RS-yes, RA-yes, MV-yes, C-yes

    b. Quasi-experimental: RS-no, RA-no, MV-yes, C-yes

    c. Action Research: RS-no, RA-no, MV-no, C-no

    d. Correlation: RS-?, RA-no, MV-no, C-no

    e. Causal-Comparative RS-?, RA-no, MV-no, C-no

    f. Qualitative RS-no, RA-no, MV-no, C-no

    g. Evaluation RS-?, RA-?, MV-?, C-?

Appendix E

Sample of DGBL Experimental Design Scenario

Table 1. *Example Scenario Illustrating DGBL Application of True Experimental Design of*

Possible Group Assignments.

Group Type	Selection & Assignment (R= Random)	Treatment Application (X)	Testing type (Pretest – O_1 Posttest – O_2)
Control Group (Random sample students not subjected to treatment –traditional methodology)	Random	None	Post test Results (O_2)
Treatment group 1 (Random selection and assigned sample students subjected to traditional and DGBL methods)	Random	Yes	Post test Results (O_2)
Treatment group 2 (Random selection and assigned sample students subjected to only DGBL methods)	Random	Yes	Post test Results (O_2)

Appendix F

Table F1. *Summary Analysis and Comparisons of Strengths & Weaknesses in Qualitative,*

Quantitative, Mixed Methods & Action Research Studies

Criteria	Quantitative	Qualitative	Mixed Methods	Action Research
	Strengths			
Use of Data Findings	• Factual data offers objectivity	• Descriptive data offers deeper insights to a problem to be explored • Voice of the participant can be heard • New theories can emerge from data findings • Population selection can be convenient or purposeful. Do not require large numbers.	• Use of both quantitative and qualitative data is added support. Numerical, Visuals and narratives can complement each other very well.	• Use of both quantitative and qualitative data is added support. Numerical, Visuals and narratives can complement each other very well. • Voice of the participant can be heard
	Weaknesses			
	• Confined to only numerical data • Research requiring random	• Subjective data tends to be researcher bias • Research findings may not be applicable to other settings if they	• Both quantitative and/or qualitative weaknesses may apply depending on design	• Both quantitative and/or qualitative weaknesses may apply depending on design

Criteria	Quantitative	Qualitative	Mixed Methods	Action Research
	selection can be a problem if there is a lack of population numbers	are special case basis	selection	selection
Design plan	**Strengths**			
	• Careful planning can offer a stable research process	• Researcher has control over design plan. Research process can be changed at any time	• Researcher has more selection options	• Researcher has more selection options. • Action plan can take place immediately • Community can set up own research base
	Weaknesses			
	• Once research plan begins, it cannot be changed	• Changes to the process of research is added work	• Both quantitative and/or qualitative weaknesses may apply depending on design selection	• Can get out of control if too much power is given to participants • "In-house" researcher must

Criteria	Quantitative	Qualitative	Mixed Methods	Action Research
				have the skills, knowledge information about the community and resources for research
Skills	Strengths			
	• A strong understanding and application of various quantitative design methods as well as math skills for statistical methods & techniques can be enriching and effective	• A strong writing skills for rich and narrative research reports can be enriching and effective	• A strong understanding and application for both quantitative & qualitative design methods is definitely an added advantage	• A strong understanding and application for both quantitative & qualitative design methods is definitely an added advantage

Criteria	Quantitative	Qualitative	Mixed Methods	Action Research
	Weaknesses			
	• Requires a good understanding and application of various quantitative design methods as well as math skills for statistical methods & techniques	• Strong writing skills are needed to draw audience into research narratives	• Skills for both quantitative & qualitative design methods as well as math and writing skills are needed	• Strong writing skills are needed to draw audience into research narratives. • Need to know descriptive research design if quantitative measures are used

Criteria	Quantitative	Qualitative	Mixed Methods	Action Research
	Strengths			
Time, Cost Factors & Ethical Issues	• Can be a faster process and cost effective depending on the instrument selection type • Once data is collected, the analysis process is fast • The need for ethical requirements on human subjects can help protect both researcher and participant.	• The need for ethical requirements on human subjects can help protect both researcher and participant.	• Both quantitative and/or qualitative strengths may apply depending on design selection	• Both quantitative and/or qualitative weaknesses may apply depending on design selection
	Weaknesses			
	• Experimental Designs on human subjects requiring ethical	• Very time consuming for write ups and interview sessions	• Both quantitative and/or qualitative	• Both quantitative and/or qualitative

Criteria	Quantitative	Qualitative	Mixed Methods	Action Research
	considerations (time to get IRB permission and approval) can be time consuming	• Data analysis such as the coding process for thematic ideas can be time consuming • Qualitative research on human subjects requiring ethical considerations (time to get IRB permission and approval) can be time consuming	weaknesses may apply depending on design selection	weaknesses may apply depending on design selection • Conflicts from researcher-participants can cause ethical issues if research goes out of hand

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