

THE CONCEPT OF MENTAL MODELS IN CO-DESIGN

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Abstract:

This study will provide an overview of mental models in teams and the significance of this particular concept for design teams. Researchers have applied the concept of mental models to understand how people perform tasks on the basis of their knowledge, assumptions, predictions and expectation. An overview is also provided on the relation between performance and mental models and their effect on stakeholders. The implications for design field are discussed. Through the study of two organizations in the same industry, the teams are studied in detail for each of these companies and hence leading to the study of mental models of stakeholders. Through the use of interviews, a detailed analysis is done on the team mental models. The mental models of stack holders and their influence on different aspects of company and team performance are discussed in detail. The methodology for the study of mental models is also proposed in the study. The findings are based on the data collected through interviews in both the organizations. The empirical study is designed in such a way that it investigates further the validity of theoretical concepts. Warid is a major telecommunication brand in Pakistan that provides services in all the regions of the country. Ufone is also a well-known telecommunication brand, known for its innovative and creative TVCs (TV commercial). Interviews with the marketing and sales officials of both these organizations provided an insight into the teams behind their advertising/marketing campaigns and the affect of stakeholders' mental models on the performance and sales of the companies. The comparative analysis between the theoretical and empirical studies suggests that the quality of mental models is affected by diversity in the team, education and experience of the team members. This may be brought in for future research to further verify the effectiveness of mental models for design teams and eventually the whole organization. Finally the implications of our findings are discussed.

Keywords: Collaborative design, team mental models, shared mental models, organizational learning, shared understanding

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1 INTRODUCTION

1.1 Background

In the past few years there have been a lot of studies being conducted on how designers think, work and act. This has led to the exploration of the concept of mental models that help in creating an understanding of the way designers think, work and act. They help in creating an understanding and then making assumptions about how any object is likely to function. It also gives an idea about how people are most likely to act so mental models can be thought of as a tool, which helps in the interpretation and selection of information. This will provide guidance regarding the behaviour of designers in various situations. Indi Young (2008) defines mental models in her book as “Mental models provide a very deep and clear understanding of a person’s motivation and thought process along with their emotional philosophical landscape in which they are operating”. (Mcshane, 2006) thinks that the longer the time that team members work together, the easier it is for them to develop common mental models, understanding and effective performance.

There is a chance of mental models being inappropriate since they are the interpretations of individuals. They can be close to reality or far from it. The individual mental models can be used, adapted and developed for designing an activity by an individual’s brain. (Boos, 2011) thinks of coordination as a process of sharing information for developing a common ground and shared mental models.

The advances in mental model are based on situations. Mostly, more than one mental model is constructed by an individual. It is important to study design in order to understand and study mental models since they are related. Most of the research that has been conducted till now is about individuals dealing with systems but they do not involve in designing them. An example of this could be medicine or aviation industry. If we consider these two, we will realize that if mental models are not appropriate in them this could cause harm to the individual operating it. This would not only harm the individual but also the people involved like in case of aviation, the passengers can be harmed. In case of management, the environment can be harmed and in case of medicine industry the patients can be caused to pay the damage. This proves that it is a very essential topic for research since it is extremely important to develop mental models that are appropriate and accurate. The mental models should not only be designed accurately but this should also be reflected in the performance, so both of them are equally important. It is difficult to define the accuracy of mental model for a design since the nature of design cannot be easily defined.

Achieving shared mental model is not an easy task. It requires settlement of uncertainties and meanings of shared information (Poole and Hirokawa, 1996; Waller and Uitdewilligen 2008). The concept of a team mental model was developed to help account for performance differences between teams (Cannon-Bowers and Salas, 1990 ± Paper presented at the SIOP, Miami, FL; Rouse et al., 1992) and refers to an organized understanding of related knowledge that is shared by team members (Cannon-Bowers et al., 1993; Klimoski and Mohammed, 1994).

The reason why the research on topic of mental models has gained more thought is the integration of these individual models with a team mental model. If the individuals in a team have a lot of difference in their knowledge, understanding of present situation and their expectation of what they aim to achieve, it might lead to a lack of coordination, understanding and wastage of time and money. There are certain limitations to individual mental models which can be overcome with the help of team models because the members in a team can challenge an individual's ideas. In case of design team mental models hold great significance especially when it comes to the development of a product. The teams make an effort to develop common goals, shared understanding and knowledge that leads to the successful development of their design. The team mental models describe both individual mental models and how they are united within a team. This concept leads to a research on how difficult problems are solved within teams.

One of the major accidents recently has highlighted the importance of team mental models in design. This accident involved the air crash in 2005 in Czech Republic due to a system being left on manual mode instead of auto. This accident resulted as a result of both pilots using the same mental model. Both the individuals in the team had the same knowledge of the aircraft and same understanding of that particular situation but their model was inappropriate that led to the accident. This proves that mental models may be the same for all individuals in a team but it is highly difficult to predict if they are accurate or not. This happens especially in cases where a complex product is being developed and it is difficult to test it.

Earlier research shows that mental models are extremely important in performance, team coordination and flow of information and knowledge among them. Still a lot is left to be studied on this topic like how they are developed, their influence on individual team member's behaviour and thinking. So our research will aim on studying this concept by reviewing previous literature to assess their appropriateness for design. In an organizational context particularly, the significance of mental models in design can be attributed to the coordination between teams and departments like manufacturing and research and development departments.

Mental models are basically human psychological interpretations of situations, real or imaginary. These are small models constructed by mind that provide explanation, reasoning and expectation of events. There are two types of mental models; structural and functional. The functional models involve knowing what action to take but not knowing why that action is being taken. Structural models on the other hand, help in problem solving. They help in creating an understanding of the reason behind actions. An example of a functional model would be shutting down a computer without switching it off properly. Mental models are studied by researchers and scientists to understand human behaviour, how they get knowledge, how they analyze things and make decisions in different environments.

Co-design is working with different individuals, and getting their viewpoint on what they expect a certain product or service to be. It involves individuals in a design process that focuses on problem solving and development of design process.

Mental models can be summarized as ideas of human mind that create their internal understanding and working of the world. They make predictions without much

thinking and effort by integrating the information provided to them. In case of performing tasks, they can also have negative effects due to their simplification. As the above mentioned case of airplane crash indicates that an inaccurate model can cause misunderstanding of a signal and hence leading to an accident.

Mental models have a huge influence on performance. The major reason for studying mental models in co-design is coordination between members in a team. It is a major assumption that mental models have a positive relationship with team performance. They provide information and knowledge about task and team. Shared mental models are significant for those tasks that demand coordination between action and team members. These models are more significant in situations where there is too much work, pressure and lack of communication. The teams that operate in a highly dynamic environment and require good communication among them like aviation crew, power plant crew, and software development teams, mental models hold the most significance. The relationship between mental models and team is dependent on task.

The previous studies on concept of mental models focused mostly on team or task mental models. Both of these models are positively related to performance. Shared task models have been found to have a better relation with performance than team models. Mental models should have three major characteristics; accuracy, importance and similarity. If it has these characteristics, only then it can be thought to be effective for performance. These mental models should be of excellent quality. The accuracy of a model is a great predictor of performance. It is highly difficult to determine the relation between team performance and mental models.

Evidence has suggested that there is a positive effect of shared mental models of team members on effectiveness and team processes. (Klimoski & Mohammed, 1994; Levine & Moreland, 1991; Mathieu et al., 2000; Weick & Roberts, 1993). Theory has also suggested that greater the convergence in mental models of team members, the better will be the overall performance of the team (Blickensderfer et al., 1998; Cannon-Bowers et al., 1993; Mathieu et al., 2000; Rouse et al., 1992). The content of shared mental models is also as much important as the convergence of mental models of members (Mathieu et al., 2000).

Since there is no defined criterion for accurate mental models in design, it is important that team communication is observed in order to understand team mental models. The problems that design teams deal with are totally different from the problems of routine tasks. Design tasks do not have any specific formula or solution so a common model needs to be developed by individuals in a team. Besides the problems of misunderstandings in a team mental model, creative synergy is an advantage due to diversity.

1.2 Statement of problem

The design of products or services is extremely importance and has a direct impact on performance. This becomes more important when it comes to complex products like the design of an aircraft and products in telecommunication. The design of such

products needs to be as accurate as possible otherwise it can result in casualties harming the users, operators and environment.

This study will be focusing mainly on the design of advertising campaigns where the findings are valid. During the process of co-design, the ideas of each individual change and somehow adapt to each other. The participants are most unaware of their pattern of thinking and the result of their mental models on design (Albinsson & Lind, 2007). Problem occurs that when the mental model of all the participants are similar; this may risk of failure for the co-design process and make it less efficient and effective. It is risky for the co-design process because some important aspects might be ignored in the design of the product/service which creates difficulties during the usage of the designed product/service.

1.3 Purpose of the study

Design is an important part of any organization that deals with clients, users or a particular market. So a detailed analysis of mental models in co-design is needed to include significant framework and knowledge. It is highly important that design is given a lot more research and importance because any inaccuracy in design can have a negative influence on performance. Not only performance is hindered but also casualties can occur in case of industries where complex design is involved.

The aim of this study to show the importance of mental models in co-design and to provide small review that shows the characteristics of mental models for the participants in co design processes. The relationship of mental models with the co-design process and its effectiveness for organizations, teams and individuals is what makes the study interesting. This study will help organizations understand the mental models concept which would lead to better formation of teams.

1.4 Research questions

- a. What is the mutual influence of mental models of participants in co-design?
- b. How do mental models of individuals in a team coordinate and adapt to have an effect on performance and efficiency of the design process?
- c. What is the relationship of convergence in team member's mental models and content of shared mental models with team performance?

1.5 Logical relations between research questions

The three research questions are highly interlinked despite having their own importance and different aspects to them. All three questions revolve around the phenomenon of mental models during co-design process and the subject of cognitive psychology. All the questions lead to the impact on team performance. The first question is regarding the mutual influence of mental models of participants in co-design. This leads us into the investigation of different kinds of outcomes that can result when the mental models of participants influence each other in the co-design process. During the time when the mental models of participants in a team are influencing each other, they are actually coordinating and adapting to each other's mental models. That is how they influence each other. This coordination and adaptation of mental models is a part of the research question 2. So the influence in question 1 is highly linked to the coordination and adaptation process of participants' mental models. Question 2 basically focuses on how mental models of individuals in a team coordinate and adapt to have an effect on performance and efficiency of the design process. So the influence of mental models on each other in question 1 leads us into their effect on performance and efficiency of process in question 2. All the influences and coordination and adaptation during the design process have a huge impact on the performance of a team which is a part of research question 3. During the phase where mental models of individuals in a team coordinate and adapt to each other, they are actually working towards a certain combined goal which enhances the team performance. All three questions are talking about how the mental models of individuals actually act together while they are working in a team, but looking at slightly different perspectives. One question leads to another and strong logical relations as described above exist between the research questions.

1.6 Target group

This research will prove to be helpful for every organization because there is no organization that does not involve designing. The groups that may find research of mental models in co-design beneficial are: Researchers (the results of research may inspire them and may support past research has been done on this particular topic), Business Organizations (the results might help them improve their design process that would result in greater efficiency and better performance), Telecommunication Industry, Aviation Industry, Software Developers and Medicine Industry. See also chapter 6.6, ideas for continue research.

1.7 Delimitations

Another aspect that is involved in designing is, understanding the mental models of the users of that particular product or service being designed. The focus of this

research is on the mental models of team members involved in co-design rather than the mental; models of users of that product or service. That is off course a part of this topic and research to some extent but the focus is on how the mental models of individuals in a team integrate to form a particular design. This designed product or service has a lot of influence and relation with the user's mental models so this would also be an interesting topic of research. The use of mental models for entrepreneurs is also a topic that could not become part of this research since it talks more about understanding the mental models of its customers.

1.8 Expected outcome

The expected outcome of this research involves:

- Identifying the determinants that affect quality of mental models in co-design
- Identifying what is needed in the mental models of team members in co-design to achieve efficiency for an organization.
- Highlighting the importance of team member's mental models for co-design and performance of the product and organization.
- A small review of the techniques for measurement of mental models of individuals in a team and their application on design.

1.9 The authors' own experience and background

The authors have Computer Information Systems (CIS) qualification and study different courses in Informatics. CIS has many courses of business and information system as in Informatics. In informatics specialization with Co Design there are different organizational concepts. The authors have directed their focus to importance of co design in organization. In this thesis work authors showed the importance of mental model in co design. The author's home country is Pakistan, where co design concepts are not in used and these concepts are very important for the organizations to compete the current economic challenges.

1.10 Structure of the thesis

Chapter one covers the background of the research and helps in forming a theoretical framework. This background study has helped in forming the main research question and three sub-questions. The background study and research questions both have influenced the research design in chapter two. The research design involves interviews, online data, books and documents which are used as data extraction methods. The data generated from these tools is then evaluated. Chapter three presents

the theoretical framework which includes key concepts, previous relevant research and the results to answers of research questions. Chapter four presents the data generated through selected tools and the results of sub-questions that have been answered. This will present the empirical study of the research. Chapter five presents a summary of the results of theoretical and empirical studies. The last chapter presents the discussion leading to a conclusion of research.

The figure below (Figure I) is the thesis structure model which illustrates the structure and chapters of this research

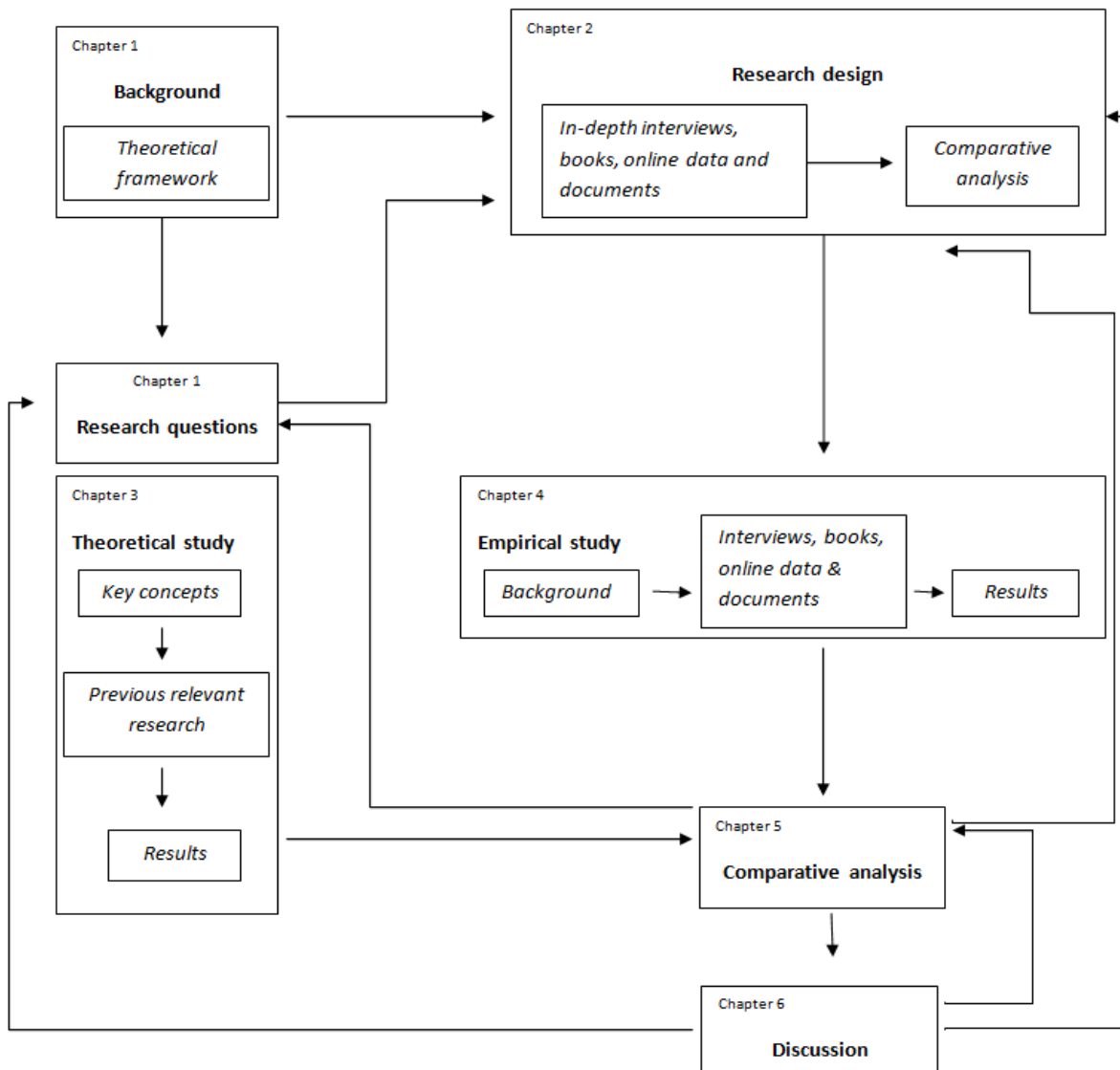


Figure 1: Thesis structure model

2 RESEARCH DESIGN

2.1 Research perspective

Positivism is an approach to observing and describing that is close to reality, from an objective view. The positivist paradigm is the traditional approach to research (Oats, 2006). It usually involves a single independent variable. This helps in identifying constancies and forming relationships. Based on observations made earlier and realities and facts already explained, the predictions are made. Interpretivism is another approach contrasting with positivist involving interpretations of reality. It is hard to say which one of these two is the better approach. For the study of organizations, interpretivist perspective can be used which is supposed to be beneficial for this kind of research. Objectivity is more closely related to positivist perspective, whereas subjectivity is close to interpretivist perspective. Considering this thesis which wants to explore the mental models in co-design, positivist perspective is more appropriate. Interpretivism intends to understand phenomenon on the basis of interpretation that results in subjective understanding of things (Orlikowski & Baraundi, 1991). Organizational studies are being more carried out through this perspective which proves that research on organizations can best be done by focusing on subjective activities of individuals. Vreed (1995) says that for Organizational Science and IS (Information Sciences) research; interpretive research was more of a custom. This was until 1970s that things changed.

Interpretivist perspective is based on the idea that social interaction is based on three major principals that are: unpredictability, actions and consciousness. Because actions can be unpredictable, this means we cannot study it in a way that positivists do. Also, individuals make conscious choices about how to act in different situations. The consciousness principle suggests that individuals are aware of themselves as well as their relationships with others. Society does not exist in an objective and observable form. In fact in experiences subjectivity because of the way individuals act and that is what defines it. In short, we contribute and create the whole social system based on daily behaviours, which each passing day contribute to the system. From the interpretive perspective, facts about behaviour can be formed but they are context bound. They are not applicable to every individual at any time or any situation. Sometimes, they are not even applicable to individuals in similar situations. The social world is interpreted by different individuals in different situations. Everything is related to every other thing. Therefore, the best way to define reality is to use the perspective of those who are involved (Chris, 2006).

If the research area is such where the world according to you is not defined i.e. information and meaning is dependent on the individual, time and setting, then interpretivist perspective is used. Therefore, in interpretivism, casual relationships in While studying the behaviour of individuals in an organization, the best way is to describe and explain it from the point of view of the individuals involved. This interpretivist methodology is inclined towards collecting qualitative data and makes use of methods like interviews and observations. That is the reason for choosing the interpretivist perspective for research on the concept of mental models in co-design

2.2 Research strategy

According to Merriam (1998), a qualitative research requires such instruments that uncover the meaning and help in collecting data and analysis. A lot of research methodologies can be used like experiments (laboratory/field), surveys, case studies, forecasting, reviews, action research, case studies or descriptive research. The methodology that will be used for this research will be survey. Surveys help in providing data about situations and views at a particular time. This can be done through questionnaires or interviews. Quantitative methods are then used to draw conclusions from data about the present relationships. The basic advantage that surveys serve is that we can study more than one variable at a time.

Not just can we understand the relation between a dependant and independent variable, but also understand the effect independent variables have on each other. In survey, primary data is mostly used for analysis, be it collected from large scale questionnaires or in-depth interviews. The data in our thesis is collected using interview approach as the specific departments of any company hold the most reliable set of information. These interviews will encircle all the variables to be analysed and questions in the interview will try to find answers and data for variable that can be analysed quantitatively

The requirement of the thesis is to analyse different qualitative elements of a mental model and observe them against the effectiveness of the product. In order to collect the required data on the elements of mental model, interviews stand out as the most effective method. To analyse the effectiveness of the product there can be a large number of quantitative indicators as well but obtaining the viewpoint of the higher administration regarding the success of the product would yield best results as they are aware of the aspects they were expecting.

The research in this thesis is targeting the telecommunication industry of the country and aims to study the mental models behind the successful advertisement and marketing campaigns. In order to obtain the required data and information, the marketing heads of two cellular companies, namely Warid and Ufone were interviewed.

2.3 Data collection procedures

Qualitative or quantitative data may be generated through this research. Since qualitative data is descriptive and focuses on creating an understanding from words, our research will be making use of it. In this research the qualitative data is gathered through detailed interviews and literature review.

Through our approach to understand the effect of mental model, interviews prove to be the most effective approach to obtain required data and information from reliable sources.

Two companies have been brought under investigation and two individuals from each company have to be interviewed. One of these two will be from the Marketing department and the other will be someone from the revenue or sales department.

From the individual from the sales department, an interview will be conducted which would help us understand that which promotional, marketing or advertisement campaign yielded best results or in other words, which campaign was the most effective and efficient.

From the marketing department we will require detail regarding the individuals working on different campaigns. These varying specifications will become our independent variables. The interview questions will revolve around the goal to understand the team and every individual in the design team of the campaigns that will be analysed. The queries will try to understand the different variables that construct a mental model. For sake of unbiased analysis, five different promotional efforts from each service provider will be considered and observed on equal criteria.

2.3.1 Sampling

It is the process of selecting units of people or organizations from a set of population that interests the researcher. The reasons for studying the samples are basically to make generalizations about the results obtained from that particular population. Quantitative models are used in one type of sampling. The two basic types of procedures used for sampling include probability and non-probability sampling. In probability sampling, each individual in the population has an equal chance of selection. In case of non-probability sampling, certain individuals are targeted. Its four basic types include: purposive samples, haphazard sampling, and quota sampling and volunteer subjects. In purposive sampling, individuals are purposely chosen for the survey. In haphazard sampling, convenience is given most importance. The people who are easy to reach are surveyed. In volunteer sampling, the volunteers are asked to take part in the survey. In quota sampling, individuals for survey are chosen on the basis of a set quota e.g. if according to the census less than half of the population is male, the sampling will be done according to that. It is important that the researcher thinks carefully about how and why a specific group of individuals is studied (Pelham & Blanton 2006).

Non probability sampling, also called convenience sampling is a sampling procedure where individuals for survey are chosen purely on the basis of ease. Any individual who can be easily accessed is made part of the study. This is mostly done or researches that are very basic and making generalizations from that narrow sample are appropriate (Trochim, 2009).

Snow ball sampling is a technique in which those individuals are located who are rich in information. Only a few prospective respondents are contacted. They are even asked about any of their contacts that possess those particular characteristics required for that research. This approach is not just limited to selecting participants who possess the required information but it also makes use of other tools. These tools can be interviews or surveys (Patton, 1990).

The above information is implying that the method used for selection of a sample should be strongly related to the research objective. Some of the characteristics of purposive sampling include small sample size, social perspective and they help in achievement of research objectives and are a part of qualitative research. The strategy used in this research is purposive sampling. Individuals are selected from two organizations based on their roles in those organizations. Only those individuals possess the information required for study.

2.3.2 Interviews

Interviews are a way of collecting data from people by talking to them and listening to them carefully. This is done in a systematic manner. The data is generated basically from the conversation that goes on between the interviewer and interviewee. Sometimes open ended questions are used. He/she is the primary data for the research. Interviews are a process of collecting data in order to gain knowledge from the individuals (Kvale, 1996). He regarded interviews as an exchange of ideas among two or more people on a topic of common interest. The interaction among individuals is regarded as a source of producing knowledge.

Interviews are a way of engaging participants and talking about their views. Interviews help in discussion of perceptions and in interpreting a certain situation. This is basically expressing from the point of view of the interviewee (Cohen, Manion and Morrison, 2000).

The interviews are not just used for collecting data regarding experiences and life. It is an experience in itself. There are numerous reasons why interviews are used for collection of data. They can include the need to collect very personal data, chances required for questioning, interviewees not being very fluent in the local language or sometimes because of problems with written language (Gray, 2004).

Preparation is the foremost and most important part of an interview. During this phase the researcher prepares for the interview and for him/her the process has already begun. Some of the things the interviewer needs to be sure of before the interview include getting a clear idea of what to ask, what the propose of that interview is and what research study it Is a part of, mode of recording the information from the interview, the timing or length of the interview and a good idea of the time and place for conducting the interview (Gillham, 2000).

Some of the benefits of structured interviews include control over the topic of discussion by the researcher and the format for the interview. A guide which provides details regarding the interview is used. There is usually a common format that provides ease in analyzing, comparing and coding of data. Besides all this it can also help in providing guidance to researchers who lack experience to conduct a structured interview. According to David and Sutton (2004), a major strength of a structured interview is that prompting is made part of the interview and if a certain question is not appropriate, data regarding no response on that can be recorded. However, it is not possible to record expressions or any non-verbal signs.

One major disadvantage that structured interviews can have included the inability to probe required information from the interviewee. Also because of a set format and guide, the interview questions might be interpreted in a different manner and the respondent might not be able to understand them well. The verbal comments and gestures of the researcher can affect the answers of the respondent. The interview type that is used least in the collection of qualitative data includes semi structured interviews. They are not standardized and do not help in testing or verifying a hypothesis (David & Sutton, 2004).

The qualitative data generated from the empirical study will be used in three major steps: fling, processing and categorizing. The requirement of the thesis is to analyze different qualitative elements of a mental model and observe them against the effectiveness of the product. In order to collect the required data on the elements of mental model, interviews stand out as the most effective method. To analyze the effectiveness of the product there can be a large number of quantitative indicators as well but obtaining the viewpoint of the higher administration regarding the success of the product would yield best results as they are aware of the aspects they were expecting. The research in this thesis is targeting the telecommunication industry of the country and aims to study the mental models behind the successful advertisement and marketing campaigns. In order to obtain the required data and information, the marketing heads of two cellular companies, namely Warid and Ufone were interviewed.

2.3.3 Documents

Documents are regarded as a source of social scientific data (Prior, 2008). With respect to generating data, documents are of two types: found and researched documents. The found documents are the primary data and the documents generated by research are the secondary documents (Oates, 2006). The reasons for production of these documents can be numerous. It can be for a certain individual or group of individuals, for organizations or any other purpose. The documents do not only include data in form of text. It might also include some visual or electronic data. Documents are regarded as the convenient and cheapest form of data generation. Their credibility can also be easily checked.

The documents used in this research include both found and researched documents. The documents that were found were produced by the telecommunication companies themselves. They were prepared for the purpose of highlighting their best advertising campaigns and the successive financial impacts on performance of the business. The data generated from the empirical study was collaborated with the found documents. Some of the documents developed for the organization were not available for the public and some could be researched through internet research. When the found documents were evaluated it was found out that they have been created with respect to a certain target audience in mind. They were created both by individuals and the organizations. These kinds of documents were mostly used for the descriptive information related to the research on the two companies. Other documents used in the study include research generated documents. Many relevant subject areas exist within the phenomenon of concept of mental models in co-design. The documents that were analyzed for the theoretical study were based on the research aspect.

Significant subject areas explored in the theoretical study manipulate themes identified in study results.

2.4 Data analysis procedures

For preparation of data and making all the 10 campaigns from 2 different providers comparable, qualitative data will be derived from the answers received in the interviews. Same data collection and data analysis techniques have been used to provide answers to all the research questions.

To obtain the 'Dependent Variable' which is the efficiency or effectiveness of the promotional campaign, interviewees from the sales or revenue department will be asked to rate the effectiveness of the campaign. This analysis will be done keeping in mind the cost of campaign incurred and the additional revenue received against the promotion. The trick at this part is that some campaigns are not designed to raise revenue in short run but, at times, only to generate brand loyalty or attract more customers which will lead to higher revenue in future periods. For this reason, the effectiveness of any campaign is not being measured by a benefit-cost ratio but the company is asked to rank the campaign, keeping in mind the targets set and benchmarks achieved.

For getting data on independent variables, detail regarding the team designing the campaign is required. This information will be taken from the interview with the marketing department of the company. The interview from the marketing official will incorporate question which will help us understand all the elements which make up an individual's mental model and thus the model of the entire team.

Some of the variables we consider that might turn out to be significant are experience and education. This interview will try to cover all such variables and find every such detail about every individual on the campaign team of the company.

2.5 Strategies for validating findings

Validating the data is extremely important to make sure that the research is strong and of good quality. The techniques for generating qualitative data have become more invasive. The validity of the study can be strengthened by using verification techniques. The variables have been divided into two distinct sets, dependent and independent. The interviews will provide a clear understanding of how the mental models affect them. The findings will be based on the analysis of information provided by interviews from the two companies.

For the purpose of validating qualitative research, cross validation is a common strategy. This technique is also known as triangulation. According to O'Donoghue and Punch (2003), triangulation is a "method of cross-checking data from multiple sources to search for regularities in the research data." This technique helps in analyzing data from several sources. This results in understanding and interpreting the results of the study. The criteria for validating data should address the following:

- i. Validating the methods for collection of data. Data can be both qualitative and quantitative. We need to question and verify what data collection methods were used.
- ii. Validating if the data from different sources is consistent. This can be done by examination of data in different time frames. The data consistency can be tested by examining data in different setting too. The difference in viewpoints should also be tested. There can be a huge difference in point of views of interviewees and survey participants. The basic purpose of this is to test whether the data was collected from reliable source or place.
- iii. In order to provide multiple perspectives on the same topic, the research findings can be analysed in a better way. This will also reduce any bias. This provides different perspectives on the same topic and by using different researchers; different perspectives on same topic can be presented. Even if every researchers provide different views and do not agree to each other's findings, it will still provide multiple ways of looking at that data
- iv. Transferability is also used to validate the findings. It tells how well the results of research can be applied to different populations.

2.6 Result presentation method

The results will be presented using detailed analysis of data gathered from theoretical and empirical studies. The results will be presented in textual form answering the questions of research. The text citation is done using the Harvard System. Comparative analysis will provide results that will also be presented in text answering all the questions of this research. Because of similar format used for displaying the data in results, making comparisons for analysis will become easy.

3 THEORETICAL STUDY

3.1 Key concepts

Co:

It is a prefix that used with different words to change the meaning it. It means to get together different words. The co word is used for the purpose to do an operation in combine way. For example co-operate, co-curricular activities, co-brother etc. (<http://en.wikipedia.org/wiki/CO>)

Design:

Design is the creation of a plan or convention for the construction of an object or a system (as in architectural blueprints, engineering drawing, business process, circuit diagrams and sewing patterns). www.dictionary.com

Co Design:

It is an American concept which says that every individual has different ideas, views and principles so every design process has to deal with it. It is basically a collective creativity that goes on in the whole design process. All those viewpoints that are related to the design in process are used. It has been found that the betterment in quality of design is the result of taking into consideration the interests of stakeholders. C. West Churchman (1968) says this about co-design: "begins when first you view the world through the eyes of another."

Mental models:

There is no exact definition of this particular concept and some definitions even contradict each other. Human reasoning is generally dependant on mental models. According to this concept, mental models are the result of our perception, how we view things, our understanding of things and imagination in our heads (Johnson-Laird, 1983).

Norman (1983) defines the mental model as the depiction of something in our minds created through communication with the target structure and continuously tailored during this interaction period. Peter Senge (1990) defines mental model as our internal images of how this world functions, images created in our minds restrict our thinking and the way we act. Most of the time we are not aware of our mental models and how they affect our behaviour.

Team mental models:

Team mental model is a shared understanding of knowledge about team member's interaction (Mathieu, Goodwin, Heffner, Salas, & Cannon-Bowers, 2000). When different individuals are working in a team, they organize their knowledge, resources, aims, and capabilities in a particular way. Every individual shares his/her own mental model which allows coordination among team members and allows them to communicate with each other and form strategies. Team members must depend on their knowledge to understand the actions of their group members and to respond in a coordinated way.

Shared mental models:

Shared mental models are the overlying knowledge and understanding of members of a team. They can be referred to as the shared images of duties, tools, working relationships and situations (Mohammed & Dumville, 2001). For a team to be effective all of these need to be shared among the members.

Team learning:

It is a process by which team members seek to attain, carve up, refine, or share task related knowledge through interaction with each other. The working of a team and learning of team members might not be possible if the team members are not committed and do not make an effort (Dochy & Bossche, 2010).

Transactive memory systems:

A transactive memory system (TMS) is a combination of an individual's knowledge and a shared awareness of who knows what (Austin, 2003; Wegner, 1987).

3.2 Previous research

Mental models have been defined in a lot of different ways in the past and most of the definitions contradict each other. The problem being discussed in this research cannot be considered to be an entirely new. The mental models present till date have not been accessed well and they have not been very successful in understanding and influencing the decision making process and actions (Doyle & Ford, 1999). There are no measures available for mental models that can be used to identify its affect on performance of organizations. Dudzinska-Przesmitzki and Grenier (2009) concluded that the majority of mental model literature is left in the theoretical field, and slight practical usefulness is achieved. This has led to this research study on mental models in organizational contexts with a focus on teams. All the methods used for bringing forth the mental models focus on mental models in general and hardly any is used specifically with respect to teams in organizations Dudzinska-Przesmitzki and Grenier (2009).

Historically, Co-design began with a goal of creating some kind of innovation that seeks to advance an educational goal. In this respect, co-design is closely related to participatory design is that it is always oriented towards the development of a socio-technical system — that is, a set of technologies and social activities in which the technologies (W. R. Penuel, J. Roschelle & N. Shechtman, 2007). A co design has always been thought to be common solutions between businesses or considerations to dissimilar parties in the designing process. Co-designs hold a lot of significance for tacit knowledge. In co-design there is an understanding that all human objects are designed and with a purpose. In co-design one tries to include those perspectives that are related to the design in the process. The quality of design increases if the stakeholders interests are considered in the design process (Albinsson & Lind, 2007). The notion of a team mental model was developed to help account for performance differences between teams (Cannon-Bowers and Salas, 1990 & Miami, FL; Rouseet al., 1992) and refers to an organized understanding of relevant knowledge that is shared by teammembers (Cannon-Bowers et al., 1993; Klimoski and Mohammed, 1994). The research on team mental models mainly started after an incident which

highlighted the importance of team mental models in design. The accident was an air crash in 2005 in Czech Republic due to a system being left on manual mode instead of auto. This accident resulted as a result of both pilots using the same mental model. Both the individuals in the team had the same knowledge of the aircraft and same understanding of that particular situation but their model was inappropriate that led to the accident. This proves that mental models may be the same for all individuals in a team but it is highly difficult to predict if they are accurate or not.

It has been highlighted through previous research that there is a positive effect of shared mental models of team members on effectiveness and team processes (Klimoski & Mohammed, 1994; Levine & Moreland, 1991; Mathieu et al., 2000; Weick & Roberts, 1993).

The previous research done on team learning and its relation to mental models has proved that shared mental models and transactive memory systems are considered to be the major mechanisms to team learning.

All the empirical literature reviewed proves that minimum amount of focus has been given to the identification of influential factors that affect mental models of stakeholders. Within the organizational paradigm a substantial amount of attention is given to the working of systems and is not the designs of those systems and the team members behind those designs whose mental models affect the final design. The final design has a whole lot of influence on the overall performance of the system. This design can cause huge damage to not only the organization but also the ones affected by its use. Limited attention is directed towards the mental models of team members. Individual mental models are given more importance. Not much research has been done on individual's mental models of organizations as well. This also affects their behaviour and performance while working for that organization. Their aims and teamwork, both are affected by this greatly. The outcomes of shared mental models of stakeholders have been studied with respect to training more rather than designing of a product or service. Mental models have been studied more in history under the concept of psychology and with respect to designing computer software. Its importance for co-design in organizations has not been the major area of study. They are considered to be more relevant for understanding the behaviour and minds of customers and designing appropriate products/services and specially computer software (Klimoski and Mohammed 1994).

A transactive memory system (TMS) and team learning concepts have been discussed many researchers, Austin, 2003 & Wegner, 1987 are the more prominent in this area. Anderson & Dron in 2011 also came up with a framework that combined effort of teacher and student. In section 3.7 we will elaborate this framework.

3.3 Relevant literature sources

In previous research discussion we have highlighted the work that has been done on this research topic in academies till date. This topic will highlight some of the major literature sources that have been used for it.

Relevant literature was selected from different books, online databases, internet and libraries. Many e-journals were browsed by subject and databases were searched by making use of the key words. The databases used were EBSCO, ACM Digital Library, and Wiley Online Library. The key words used include organizational communication, collaborative design, team mental models, shared mental models, organizational learning, shared understanding, organizational efficiency and Transactive memory systems. All the referenced articles in the literature review were published in generals for both academic researchers and experts.

Mary M. Somerville and Zaana Howard's article: "Information in context: co-designing workplace structures and systems for organizational learning". Mary M. Somerville is a University Librarian and Library Director for the Auraria Library at the University of Colorado Denver, USA. She also teaches as a professor in the School of Library and Information Science at the San José State University. She is also an Associate Dean in the Dr. Martin Luther King, Jr. Library at San José State University, California and Assistant Dean in the Robert E. Kennedy Library at California Polytechnic State University in San Luis Obispo, California. Zaana Howard is a PhD student in the Faculty of Design at Swinburne University, Melbourne, Australia. The purpose of her research is to use design thinking and participatory design to redesign organizations as adaptive social ecosystems. She received her Master's degree in Information Management and Systems, majoring in Knowledge Management and Library and Information Sciences at Monash University, Melbourne, Australia.

Marc Steen, Menno Manschot and Nicole De Koning 2011 article: "Benefits of co-design in service design projects" was published in International Journal of Design, ed. 5, vol. 2, pp. 53-60. March Steen is a graduate of TNO, Delft, The Netherlands and Menno Manschot is a graduate of Delft University of Technology, Delft, The Netherlands.

Kathleen M. Carley, 1999 article: "Extracting team mental models through textual analysis" was first published online on 5 JAN 1999. The author is of Graduate School of Business, Department of Management of Organizations, Columbia University, Uris Hall, New York, New York 10027, U.S.A.

Petra Badke-Schauba, Kristina Lauchea & André Neumann (2007) article: Team mental models on co-design" was first published online on 27 Feb 2007.

Susan Mohammed*, Brad C. Dumville (2001) article "Team mental models in a team knowledge framework: expanding theory and measurement across disciplinary boundaries" was first published online on 13 MAR 2001. The author is from The Pennsylvania State University, Department of Psychology, Pennsylvania, U.S.A.

3.4 Subject areas relevant for the research

Below diagram shows different subject areas that are related to our research work and followed by study on these subject areas in order to find out theories that will strengthen the theoretical part of this research work. The authors have chosen to link the subject areas to the field of psychology. This is one of many fields where scholars

have contributed to the development of the concept. Other research fields are organizational theory, informatics, human-computer interaction, management and linguistics. The motivation behind choosing the field of psychology was that during the design process of any product or service, usually a team sit together for problem-solving. The kind of communication and interaction that goes on between them is based on the psychology of individuals in the team. So in order for teams to perform better and eventually benefit the organization, the study on the subject of psychology is really important. This was basically the driving force behind choosing the field of psychology.

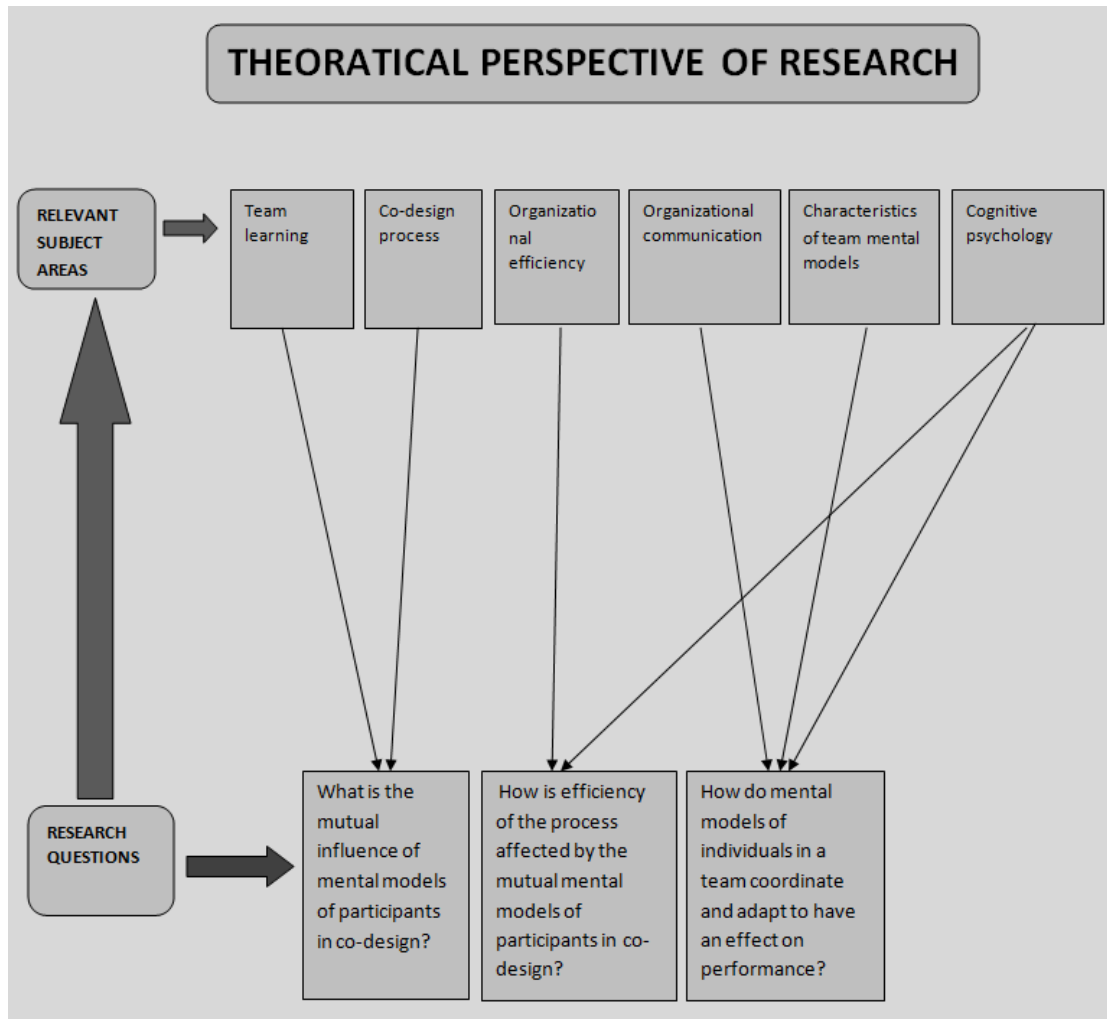


Figure 2: Relevant subject areas

3.5 Cognitive Psychology

Cognitive psychology is a branch of psychology that explores internal processes of brain. It investigates people perceptions, remembering ability, thinking, speaking, and problem solving abilities (Feist & Rosenberg , 2009).

The term "cognitive psychology" was originally coined by Ulric Neisser, who was an American psychologist. This term was used in 1967 in his book *Cognitive Psychology*. According to Neisser, cognition involves "all processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used. It is concerned with these processes even when they operate in the absence of relevant stimulation, as in images and hallucinations. Given such a sweeping definition, it is apparent that cognition is involved in everything a human being might possibly do; that every psychological phenomenon is a cognitive phenomenon. (Neisser, 1967)

Cognitive psychology is basically the study of human thought and what mental processes go on that shape behaviour of humans. This includes perception, memory and language etc. Research in the field of cognitive psychology says that individuals construct an instinctive understanding of the world which is based on their life's experiences. According to cognitive psychology, mental models comprise of two main elements. These include knowledge structures and operations for using the knowledge. A careful analysis of subject matter aids not only mental models but also knowledge objects. In order to enhance the process of learning, stakeholders have accepted the importance of analyzing subject matter. Learning can be facilitated with proper selection of knowledge, organization and series. More emphasis is always on systems, and not on mental models that shape strategies for their development. Learning is best facilitated by the sharing of knowledge and ideas. In cognitive psychology, researchers have come up with many different kinds of presentations: proposals (Anderson & Bower, 1973), images (Kosslyn, 1980; Paivio, 1971), semantic nets (Collins & Loftus, 1975), schemas (Brewer & Nakamura, 1984; Rumelhart, 1980), and mental models (Johnson-Laird, 1981, 1983).

Mental models can be used in a variety of ways (Johnson-Laird, 1983; Gentner & Stevens, 1983).it can be said that mental model is something that is created when questions are to be answered and problems are to be solved. It can also be used when dealing with different kinds of situations.

The cognitive theories of psychology focus on internal issues like motivation, decision making and problem solving. The developmental theories include human growth, development and learning processes. According to Piagets's theory, a schema defines the mental and physical behaviour that takes part in understanding and knowledge. According to him schema includes the type of knowledge and how that knowledge is obtained. The new experiences help in modifying, adding or changing the already existing schemas. When more information is added to the already existing schema, this process is known as assimilation and when any modification is made to the existing schema hi information is known as accommodation. Assimilation is inclined toward subjectivity because of the modifications due to experience and the added information is somehow blended with the existing beliefs. Accommodation on the other hand is the modification of existing schemas which is the result of new experiences or new information. It might involve the development of new schemes (Piaget, 1977).

According to Gardner's theory of multiple intelligence, the way intelligence viewed is a very limited concept. This theory was first introduced in 1983. In the book *Frames of Mind: The Theory of Multiple Intelligences*. Gardner suggests that every individual has a different kind of intelligence. According to him there are eight kinds of

intelligences. There is also a ninth one that can be added to the list. For capturing the whole variety of capabilities and talents that people have, they do not have a single intellectual capacity. They have musical intelligence, interpersonal intelligence, visual intelligence and linguistic intelligence. Different individuals are stronger with different intelligences. Some might have a better musical intelligence and some might have a better visual intelligence. According to him, the individuals who possess musical intelligence usually have a wide range of abilities. This theory has been criticized from the educational as well as psychological perspective. His definition of intelligence is considered to be very broad. Despite the criticism, this theory is extremely popular with educators (Gardner, 1983).

3.6 Co-design

In literature, 'customer co-design' is described as a process that allows customers to express their product requirements and carry out product realization processes by mapping the requirements into the physical domain of the product (Khalid & Helander, 2003; von Hippel, 1998). This leads to the customer choosing a personalized combination of product from an infinite set of options. During this entire process, the customer is made a part of the value creation of the supplier. The customer becomes a co-producer or "prosumer" (Toffler, 1980). It is more appropriate to call a consumer a co-designer instead of a co-producer because the main part of interaction takes place during the configuration and design of the customer specific product, with the customer. Co-design is used to express cooperation between a customer and the producing firm, during the process of configuration of a customized product. (Franke & Piller, 2003, 2004; Franke & Schreier, 2002; Wikstram, 1996).

Another concept is of "collaborative customer co-design in online communities". This process takes place in collaboration among the users or the consumers of a specific product. This form analysis can include other members of the market, such as the retailers, the whole sellers or the producers, especially if the entire co-design concept has been initiated by the firm, but the consumers are the most important element.

Participatory Design is a concept and approach to design that involves the end users of the designed product or service. This has been done to investigate whether the needs and wants of the user are being served to, and if they are not, what should be changed to achieve a more satisfactory situation. "They enable immersion, dialogue and empathy; we start to understand the design from the point of view of the participants. The outputs are sources of both inspiration and information for designers and participants to work with in visioning future designs. They are information gathering and design generating activities, blurring the boundaries of research and design" (Sanders 2008).

The goal of the entire activity is to discover and understand the participants and their requirements. To understand an individual, not any one specific are can be targeted. In order to get a complete set of information, a large number of questions are placed to understand a participant. These questions may target areas such as relationships, fears, dreams, places, thoughts, attitudes, activities, frustrations, priorities and motivations. The list is not limited to just these points. But, 'people are not explicit sources of

information' (Greenbaum and Madsen 1993). Getting this kind of information from is rather difficult because the ways of expression are quite limited. Most of the people know no other way to express in, other than their most used language. Religion, dreams, goals, attitudes, habits or rituals are few of the things which are really hard to explain in a quantifiable manner as the individual might have not even be aware of them.

To eliminate this problem we retreat to a generative' design research method. This helps make things that are normally unobservable available as resources for design Sleeswijk Visser suggests that 'while methods such as interviews and observations give us access to the explicit and observable, generative methods allow us to access the tacit and implicit aspects of people's lives'. According to him, generative methods are designed to, "allow us to gain access to a hidden world of user experience" (Sleeswijk Visser, 2009)

Co design in this respect has been addressed by large number of researchers in recent history but a concrete definition is found in the works of W. R. Penuel, J. Roschelle & N. Shechtman. They define co-design as a highly facilitated, team-based process in which teachers, researchers, and developers work together in defined role to design an educational innovation, realize the design in one or more prototypes and evaluate each prototype for addressing a concrete educational need. Although there are important roles for teachers as participants in co-design, it is not a fully democratic process. Instead, accountability and ultimate responsibility for decision making rests with the project leaders, who are ultimately responsible for the quality of the educational resource being produced. In this section, we describe seven characteristic features of co-design as a method. Co-design takes on a concrete, tangible innovation challenge. Co-design begins with a goal of creating some kind of innovation that seeks to advance an educational goal. In this respect, co-design is closely related to participatory design in that it is always oriented toward the development of specific socio technical system — that is, a set of technologies and social activities in which the technologies. (W. R. Penuel, J. Roschelle & N. Shechtman, 2007)

Co-design can only be considered successful when a critical task is completed by team and tall the requirements are met. "In documenting practice through "taking stock" in co-design has many similarities to rapid ethnographic techniques that are used in the design of workplace technologies (Hughes, King, Rodden & Andersen, 1995; Millen, 2000)."

3.7 Team learning and Transactive memory systems

A transactive memory system (TMS) is a combination of an individual's knowledge and a shared awareness of who knows what (Austin, 2003; Wegner, 1987). The quality of mental models also contributes to team learning, which is an important part of any activity in an organization that involves teams. So the concept of team learning and its relationship to shared mental models is related our main research question. Shared mental models and trasactive memory systems are considered to be the major mechanisms to team learning. They affect team factors like performance, learning, creativity, agreement and feasibility. Specialization, coordination and credibility are the components of transactive memory systems. They predict outcomes of teams

much better. Credibility tells about the performance and creativity of teams whereas coordination tells about the satisfaction of team members. Team performance is dependent on shared mental models.

With every coming day organizations are becoming more service oriented and have started depending a lot on knowledge workers (Blackler, 1995; Davenport & Prusak, 1998). What organization are doing these days is capturing the collective knowledge of individuals in a team and trying to benefit from it (Edmondson, Bohmer, & Pisano, 2001; Katzenbach & Smith, 2003). It has become really important for organizations these days to encourage teamwork so that every individual can share his/her knowledge and ideas. It becomes possible by the adaptation of each other's mental models in a team. Problem solving, creativity and understanding of situations can better be served by this. Individuals in a team learn from each other by sharing, refining and combining their knowledge about tasks and situations which is done by communication with each other and sharing of mental models among team members.

A transactive memory system (TMS) is a grouping of a team members' knowledge and understanding and a common knowledge of who knows what (Austin, 2003; Wegner, 1987).

Firms depend heavily at times on groups and teams to carry out strategic plans and make important decisions based on the conditions. The action is regularly justified as an effort, to improve its outcomes through better knowledge and insight (Fiol & Lyles, 1985) or is dependent on the ability of its teams to learn (Senge, 1990; Edmondson, 2002). Teams, defined as work groups that exist within the context of a larger organization and share responsibility for a team product or service (Hackman, 1987), are an efficient way of accomplishing work.

In today's organizations, these teams, develop strategy, deliver services, design and produce new products and/or execute other actions which are related to organization efficiency and performance. The only way to maintain an edge in an ever evolving world and an ever challenging economy is to develop new ways of acting and performing as a team. A team has to come up with new ideas and keep on making their performance more effective and efficient.

Behaviourism is a theory that relates to learning and the acquisition of behaviours that can be termed as 'observable'. The aim of any instruction, according to a behaviourist's perspective is to "enable the majority of students to achieve levels of performance that were pre-determined in terms of behaviourally defined objectives" (Tennyson, 2010, p. 2). This leads to "small, incremental steps sequenced to link information in a logical order [and] active learner participation in responding to instructional stimuli with immediate feedback as a positive reinforcer" (Tennyson, 2010, p. 2). Behaviourism is characterized by specific objectives, small steps, right or wrong answers and measurable performance criteria (Kennedy & Norman, 2011).

Focus of Cognitivism is on "learners' internal environment and cognitive structures" (Torre, Daley, Sebastian & Elnicki, 2006, p. 904). In this regard, "the learner uses cognitive tools, such as insight, information processing, perceptions, and memory, to facilitate learning by assigning meaning to events" (Torre et al., 2006, p. 904). Cognitivism says that the entire concept revolves around the learner as the learner

understands and absorbs new concepts according to his perception and convenience. ‘Strategies associated with cognitivism include case studies, research, discussions, self-assessment and presentations (Shirley, 2009).’

Constructivist’s debate says that “knowledge is both individually constructed and socially co-constructed from interactions and experiences with the world” (Jonassen, Cernusa, & Ionas, 2007, p. 4). Learning whereas, “emerges from practice (or activity) and from discussion and reflection on that practice” (Jonassen et al., 2007, p. 4). Constructivists state that “learning situations that promote the engagement or immersion of learners in practice fields (simulations, project-based, inquiry-based, problem-based) activities and fields of practice (communities of practice, apprenticeships, workplace activities” (Jonassen et al., 2007, p. 4).

Connectivist’s teaching “focuses on building and maintaining networked connections that are current and flexible enough to be applied to existing and emergent problems” (Anderson & Dron, 2011, p. 87). The role of the learner on the other hand is “not to memorize or even understand everything, but to have the capacity to find and apply knowledge when or where it is needed” (Anderson & Dron, 2011, p. 87). In the framework provided by the connectivist learning, a combined effort from the teacher and the student leads to creation of material that will aid future students, and ‘assessment is a combination of self-reflection and teacher assessment of the quality and quantity of your contributions (Anderson & Dron, 2011).

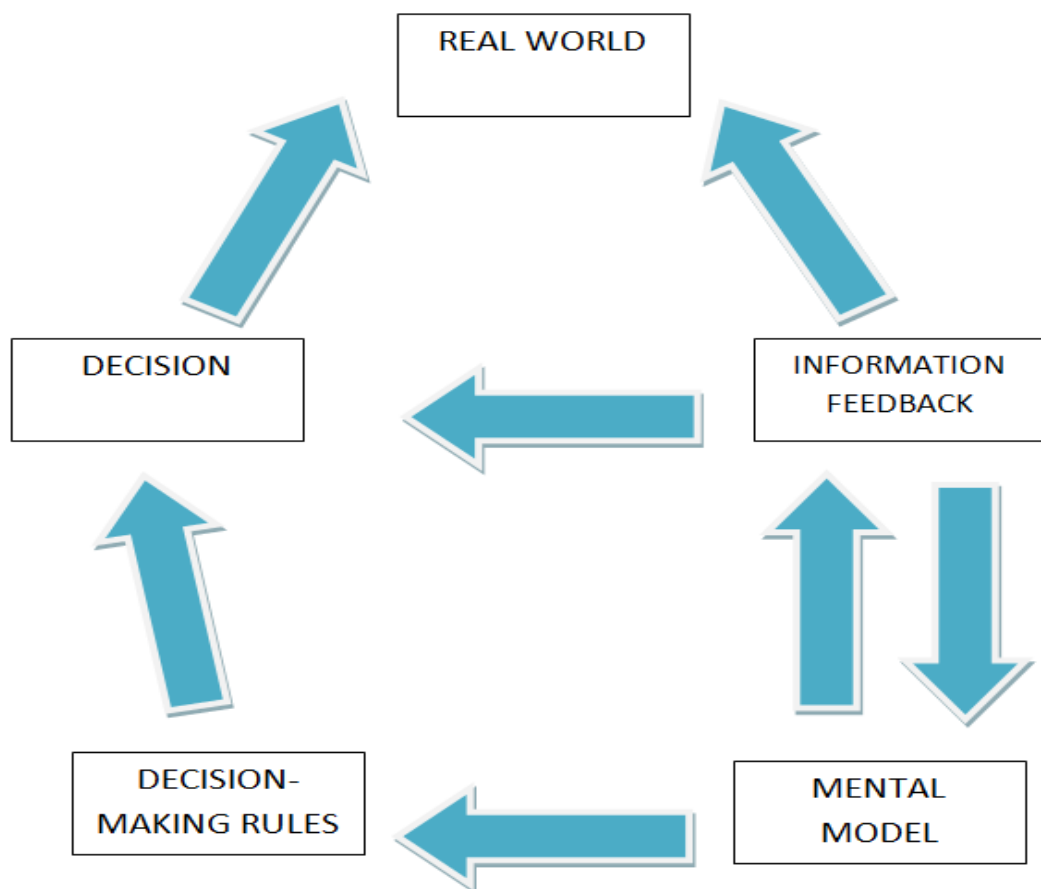


Figure 3: Mental models and learning & decision-making (Archana, 2009)

The above diagram, figure 3 shows how information feedbacks influence our existing mental models. Our mental models keep on changing with the feedbacks that we keep receiving. This results in an influence on our decisions. Therefore there is a need to understand mental models. There is a need to form a solution related to our learning based on this. This can be done by appropriate investigation and in-depth interviews or even detailed discussion with individuals. The information helps our learning process along with providing training and altering our existing mental models.

3.8 Organizational Communication

Communication is a frequent activity in every human's life but it is not given that much importance and its complexity is often ignored (Littlejohn & Fost, 2008). The theory of communication needs to be explored in order to understand it better. This is a relevant subject to study linked with our third sub question which talks about how team members' mental models coordinate and affect performance. The team members communicate and coordinate with each other, share their ideas and knowledge which results in better designing of a product or service they are working on. It is very important how team members communicate with each other and adapt to each other's mental models. It is only when they make use of their difference in imagination, creativity and ideas and come to the same level where they understand the need to choose the best alternative leading to problem solving. For tasks that involve a lot of difficulty in communication, shared mental models are used to cope with that. Situations where there is a great need for exchange of information between team members; team performance can be improved and benefited from shared mental models. In case of situations where a limited amount of communication was possible due to the lack of time or too much work, shared mental models were found to be most effective (Mathieu et al. 2000).

Even in case of tasks which do not have any pressure of time or work, or when tasks are carried out in form of teams that do not share all the necessary information, shared mental models have proved to be effective. That is because they contribute in improving communication which leads to a better performance.

Communication is an important part of any organization and it becomes even more important when a team or a task force are working on something. It is only through efficient system of communication and interaction among team members that relevant information is gathered for problem solving. The more the team members share their knowledge and understanding of a problem, the more innovative approaches to problem solving are recognized. The mental models of individual team members restrict them from thinking and acting in certain ways because their behaviours, views and understanding of things are shaped according to their experiences. Every individual in a team would have different mental models and some of them will be accurate for that particular task or problem and some might be inappropriate. In this situation where a team is involved, it becomes necessary to have a very good communication among team members so they can coordinate and understand each other, share their visions and creativity. The mental models of team members should adapt to each other but at the same time the diversity in views has its own benefits. With better communication and openness to criticism and new approaches, the efficiency can be improved. In the different approaches to organizational

communication teams are used mostly in top-down approach. In order to solve problems effectively, grab the best opportunities, achieve set goals, communication is essential and questions need to be answered need managers. They are the ones who are responsible for the organization (J. F.,2008).

The organization affects the mental models of its employees as well as their propositional representation. Both of these interact with each other and help in model construction. The mental models affect not only the visual perception but also text surface representation. Same goes for the effects of propositional representation. The visual and verbal organization affects both of these and they help in comprehension of texts and diagram.

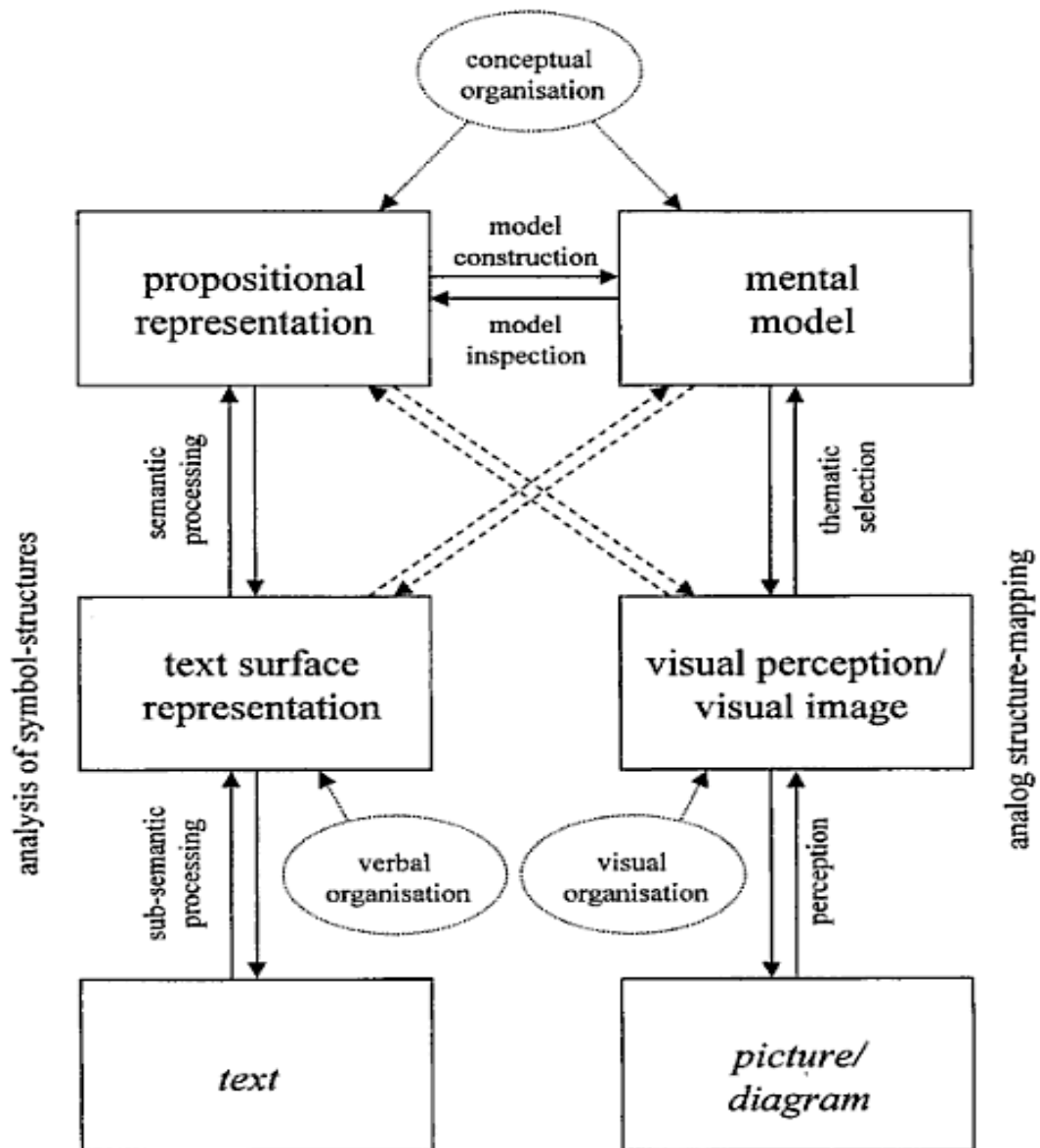


Figure 4: Model of text and picture comprehension (Wolfgang & Maria, 2003)

	TEXT CONTENT	TEXT ORGANIZATION
ORGANIZATIONS	Content should have following effects on recipients mental models: <ul style="list-style-type: none"> • Make mental models more complete and accurate • Help in decision making 	Organizations should utilize structure to highlight major components of content
DESIGN OR EVALUATION METHODS	Cover important information and address misconceptions	Stress important on formation

Table 1: Mental models approach to communication design

The above table illustrates what the mental models affect related to the text content and text organization. The affect of text content for organizations include making mental models complete and accurate and helping in decision making process. For the text organization, it helps in highlighting the major textual components.

3.9 Organizational efficiency

According to (Rumble, 1986), organizational efficiency is the extent to which an organization produces a certain level of output with very few resources used. The ability of an organization to produce the maximum amount of output desired with the minimum expenditure of resources, time and effort. Capacity and results are the two terms which define the internal and external characteristics of organizational efficiency. Any organization striving to achieve maximum output with the minimum expenditure has to rely a lot on its employees. The teams an organization makes are the ones that can work together to help an organization achieve its goal with their combined effort and shared mental models that would reduce the time and effort for any task.

Organizational efficiency is the attainment of desired results with the minimum amount of resources, input, time and money. Specially for reducing the time and money in any organization, the best approach is to use teams that help in designing products or services and help in problem solving. Here, the concept of creative synergy also comes in. The more the mental models of different individuals coordinate and adapt to each other, the more is the creative synergy. Sometimes just the interaction of two contradicting mental models can contribute greatly to problem solving. The better the company utilizes its employees, the better it manages its teams and the more the diversity is in the teams, there is a greater chance that efficiency will increase. (Rumble, 1986)

Mental models play a significant role in shaping behaviours, so the content is of great significance and has a huge impact on the effectiveness of team.(Mcshane, 2006) thinks that the longer the time that team members work together, the easier it is for them to develop common mental models, understanding and effective performance.

The process of co-design is what shapes the design of the product or service. It is extremely important to understand the concept of mental models for co-design. Only if the co-design process is efficient, it will lead to a better design which would eventually enhance the efficiency of organization and its business operations. Organizational efficiency is the extent to which an organization produces a certain level of output with very few resources used. These resources can be reduced by making use of efficient technology which reduces the input and effort and also helps in achieving maximum output (Rumble, 1986).

Organizational efficiency is an indicator of how well the company has succeeded in utilizing its resources. It can be measured as a relation between effectiveness and expenditure. Some public organizations define organizational efficiency as the ability of an organization to increase its profit level through the use of equity and debt. Organizational efficiency can be attributed to a large number of factors. Every organization will define it differently. For some organization organizational efficiency is dependent a lot on the its use of information technology. Information systems of some organizations help in achieving efficiency. It is also important for organization to monitor their organizational efficiency so any loss is prevented Gish, 2012).

The creative synergy as a result of different mental models of designers in a team leads to development of such efficient systems. The better the company utilizes its employees, the better it manages its teams and the more the diversity is in the teams, there is a greater chance that efficiency will increase. (Rumble, 1986)

3.10 Characteristics of team mental models

The mental model of any individual is dependent on a large set of variables but some significant variables which affect all are discussed below.

3.10.1 Education/knowledge of team members

Education of any individual has a very significant impact on that is not only actions but also reactions of the person to any event. His reactions and judgements regarding any scenario gain accuracy as the education increases or the knowledge on the topic gets advance.

As the education level increases so does the depth of understanding of any topic. But education is not the only source of understanding by an easy to measure reliable indicator. For example a course in political science can teach you basics of the subject or provide you with elemental understanding of the subject but to grasp the subject firmly, a vast knowledge of world politics and historical political events is required which the course might not provide. A few more or advanced courses in the subject may help to increase knowledge (Bolstad 1999).

An individual with only adequate education and limited knowledge will have a shallow understanding of the subject at hand but an individual with extensive education and vast knowledge will have deep understanding and will more accurate estimates and better suggestions to make.

3.10.2 Experience (accuracy)

The practical world is not dominated by the detail in books but rather by the complications of practice. Experience in any field thus proves to be a very vital element in formation of a mental model.

All that is required in the world of business is correct and accurate decision making which would result into positive and profitable situations. This accuracy can be gained through excessive education in a field but experience is still required at the end of the day to learn the tricks of trade. An individual with a bachelor's degree maybe be better equipped for the job due to his experience in the field than a fresh master's graduate.

As the experience of any individual in a field increases, his/her understanding of the subject grows, evolves, mutates and expands with it thus constantly changing the mental model of the individual and the team he is working with.

Staw (1980) also emphasizes the possible negative impact of experience. He says that as skill increases with tenure, but effort and drive decrease over time, generating a not so good effect on performance.

3.10.3 Diversity (different view points)

Plowman (2010) argues that with the increasing use of teams and globalization, it has become highly difficult for organizations to manage highly diverse groups. Diversity in any team is expected to be of great significance because of the added advantage it provides. Diversity can be gained by having team members from different countries, religion or schools of thought. This can lead to better covering of the topic and lower chances of leaving an important question unanswered. For example if a fast food chain is being designed for the city of New York, having individuals from different religions can help increase the revenue of the business. Having a Muslim on the team will make sure that halal food is available for Muslim customers which will lead to larger market coverage and better turnover. Having a Hindu member on team will take care of vegetarian Hindus who cannot have meat due to religious concerns.

Incorporating diversity into the design team of any project is a fast food chain or a promotional campaign, the effectiveness of the product is expected is increase.

3.11 Summary of theoretical findings

The results of the theoretical study are displayed below as they are correlated to the research questions that support the main research question.

- *What is the mutual influence of mental models of participants in co-design?*

Theoretical study has suggested that the longer the team members work together, the better the understanding and coordination among them. Their mental models coordinate and adapt to each other better. Despite this, diversity among team members leads to more creativity and innovation. The more different and creative concepts come from different minds, the less is the chance that any important aspect will be overlooked. When different individuals work towards problem solving, it becomes extremely important to look at each and every available option, opportunity, idea and minor detail. The better the mental models of individuals are integrated; the better will be the design process. Creativity and innovation always requires fresh and different concepts. Sometimes one person's mental model restricts his/her thinking towards only one direction. In this case it becomes really important that the mental models of team members coordinate, adapt to each other, share knowledge and create an understanding. Together these mental models can lead to something better and innovative without any boundaries and restrictions of a mind due to its mental model.

- *How do mental models of individuals in a team coordinate and adapt to have an effect on performance and efficiency of the design process?*

The theoretical study provides some very simple yet significant explanations regarding the mental model variables and the success of the product. Any and every team requires individuals who are adequately educated to start with. On very rare occasions will there rise need of an uneducated member. Normally this need is fulfilled by an individual who has experience in the field of concern but for the success of any product, the team needs to be educated adequately and to have the edge, some of the individuals should have extensive knowledge regarding the topic. A more educated team will produce a better and more effective product than an uneducated team. This however does not mean that education is a guarantee of a successful produce. Experience plays a very important role at this point. Experience at times gains more importance than education but both the elements are necessary but not sufficient for the success of any produce. The last element is diversity in the team which has always been affiliated to thinking out of the box and has a positive impact on the effectiveness of the product. A diverse team will be able to cover the design of the product in a better way and produce a better product.

- *What is the relationship of convergence in team members' mental models and content of shared mental models with team performance?*

Theoretical study has suggested that greater convergence in mental models of team members leads to better performance and better problem solving. A lot of researchers have agreed to this, but argument is presented in history regarding the content of shared mental models having the equal amount of importance. The team members for example might converge around some model or concept but if the content is not right, what they believe is just a limited approach to something then a lower level of effectiveness, practicability, growth of team members and customer satisfaction will result. Mental models play a significant role in shaping behaviours, so the content is

of great significance and has a huge impact on the effectiveness of team. It is assumed that the content of shared mental models is of more significance during the initial stages of team development. The reason for that is it has more impact on shaping the behaviours of individuals and their actions and the way they go about doing things is not yet habit. It is not something that they would automatically do.

3.12 Arguments for an empirical study

The theoretical study has provided the theories that showed the characteristics of mental model of the participant in co design that is education, diversity and accuracy. In order to study in more depth and for specific characteristics of mental models of participants in co-design process the empirical study is needed. The empirical study will be providing with a clearer view on that which would in return explain more about the mutual influence of mental models of participants while they coordinate and adapt to each other. The empirical study with reference to two organizations is expected to, In order to give stronger arguments to the results of the literature study; an empirical study is carried out

Empirical study helps to eliminate any and all doubts regarding the relation between the dependent and any of the independent variables and provides with accurate results. Theory suggests that diversity in a team can lead to better products but a highly diverse team can also lead to confusion and deadlocks in the design process. Ambiguities of this type can be eliminated using empirical approach. Furthermore theory is able to define the direction of relation between a dependent and an independent variable.

In qualitative research, the results of theoretical study are authenticated by a following (empirical) study. The confirmation of the recognized themes in the theoretical study will be confirmed by comparatively analysing the results of both the studies. The empirical study recommended here is firmly connected to many significant areas of the theoretical study in which identified determinants are supported. The empirical case chosen is supported by in-depth interviews.

4 EMPIRICAL SURVEY

The empirical study will help in generating some additional knowledge to the current knowledge in field of mental models in co-design. The theoretical knowledge was able to generate quite a lot of information regarding the topic which helped in formation of theoretical framework. However, there is no clear understanding of the different characteristics of individual mental models historically, so this research will provide an insight on that.

4.1 Purpose

The knowledge expected to be created through this survey is about the characteristics of mental model that have an effect on the design of a product or service. As explained above, mental models of team members are expected to have an effect on the design and the creative synergy enhances the outcome. This survey will provide us with detailed information with respect to three company's data about their advertising campaigns.

It will give us information about how effective each advertising/marketing campaign has been and what was the team behind it. The effect of mental models of that team's members on the results of the campaign will be evaluated. The relationship between the mental models of team members and design of campaign is what we expect to analyse through our survey.

4.2 Sampling

The companies that we have chosen for our study are two telecommunication companies. Their marketing/advertising campaigns will be evaluated with respect to their teams for each campaign and team mental models will be studied by considering the effectiveness of teams on the design of campaigns. The two major telecommunication companies of Pakistan will be studied: Warid and Ufone. In order to study the effect of mental models on design it was decided upon to study the design of advertising/marketing campaigns of these three companies. The observations will be based on the findings from these two companies. Since the data is supposed to be collected through interviews, the marketing and finance department officers will be interviewed for various advertising campaigns and their effectiveness considering the sales or expected results from those campaigns. Interviews with the marketing department officials will help in generating information about the characteristics of mental models and their effect on team performance. The interviews with marketing officials will try to cover all the variables of mental model that will have an effect on the design of the campaigns. The marketing and sales departments' information was required, so one officer from each of these departments of all two companies was selected for the interview. The interviews will be able to generate detailed and most accurate information so selecting one officer from each department for the interview was considered to be the best option.

4.3 The interviews

Preparations for the interviews were based on the research strategy including decisions about the company to study, type of data, the time and length of study, arrangement and documentation for the documentation. The technique for the interview helped in designing the interview guide. The structure for questions was first formulated and then the interview questions. It was essential that the company officials express in detail all the experiences and point of views. The interview questions were first tested in order to be sure that they will not be misinterpreted. The interviews were arranged in advance by establishing contacts with the sales and marketing department officials and confirming the time and place for the interviews with them. The interview schedule was confirmed considering the time suitable for the informants of the interviews.

Structured interviews were selected as a technique to collect relevant information. Since we do not require information about different aspects and the information required is limited to the two department and the design team so structured interviews were considered to be most appropriate. Structured interviews are used for collecting statistical as well as qualitative data. Data is collected through an interviewer instead of a questionnaire. Open ended questions are also used for a structured interview. The structure of questions is fixed. The structure of the interview was such that the informants share maximum information and feel at ease sharing their experiences and knowledge about the concept been studied.

At the time of the interview, first the information regarding the research purpose was explained and the intention for conducting that interview. An understanding was created in this particular time. General conversation between interviewer and informant is essential for the creation of mutual respect and trust, which helps in creating a relaxed environment for the interview (McGinn, 2008). The documentation for the interview was done by recording which helps in capturing data easily and in detail. The collected information was then transformed on paper in a written text format. This allows for a more structured format of information and easy categorizing which helps in a better evaluation of information.

4.4 Relation between research questions and interview questions

The interview questions were formulated keeping in mind all the research questions. It was made sure that the interview questions for both the companies are formulated in such a way that they are able to generate answers for each research question. The research questions were answered by considering five advertising campaigns of each company independently. The teams behind those advertising campaigns helped in the investigation on mental models which are a common phenomenon being investigated in all the research questions. The kind of impact that the advertising campaigns had on the sales, profitability or by any other means on the company were better explained by the information from respondents of the sales department. Each research question tries to investigate the link of mental models with different things like individuals themselves, process and organizational efficiency and team performance. These three

are a part of the three research questions. So the research questions were the basis for interview questions. The interviews with the marketing officials in both the companies helped in generating information related to research question 1 and a part of research questions 2 and 3. The relationship between the team members' mental models and the information regarding the team members was provided in detail by the marketing officials of both the telecommunication companies since they are closely associated with the formation of teams for advertising or marketing campaigns. So the interaction and adaptation of mental models of participants in a team were better explained by the questions asked from the respondents in the marketing department. The characteristics of the participants were also investigated through the interview questions from the marketing officials along with the influences of team members' mental models on each other. The interview questions that were formulated for the sales officials in both the companies basically helped in investigating the influence of mental models on team performance and efficiency of organization overall which were a part of research question 2 and 3. The interview questions formulated for both the departments in each company created a link between the relationship of mental models with team and organizational performance. The mental models were studied in detail through investigating from the marketing officials and the kind of influence that they have on organizational efficiency, team performance and participants themselves were better understood by interviewing the sales officials.

4.5 The first interview (Warid)

Warid is a major telecommunication company in Pakistan which is based in Abu Dhabi. Sheikh Nahayan Mubarak Al Nahayan is the chairman of Warid. It is one of the largest operators worldwide and has 18,000,000 in Pakistan. Warid Telecom has a 30% stake in Pakistan. Blackberry is one of the products that it offers. It offers a wide variety of packages with great price plans and offers. The packages and offers attract thousands of customers. It keeps updating its offers, banners and advertising campaigns with respect to its customers. Most of the advertising through sites has been able to attract a broad range of customers. It offers exceptional services to its customers. It has a wide variety of post-paid and pre-paid offers that it provides to its customers. The information was collected through two informants, one from marketing department and one from the sales department. Informant 1 which is from the marketing department has been working with the company from many years and is responsible for the advertising and promotions of the brand. Informant 2 is from the sales department and will provide all the information regarding the sales and revenues generated as a result of different advertising campaigns.

4.6 The second interview (Ufone)

Ufone is the name under which PTCL started its operations in 2001. Ufone got privatized and became a part of Emirates Group. Ufone has always focused on its customers providing them with services that are better than any other service provider and that too at a reasonable cost. Some of the qualities that it claims to have included best network coverage, lowest call rates and the most simple tariff plans. Over the last few years one of the highlights of Ufone has been its advertising campaigns whose humour has attracted a wide range of audience. So it can be said

that Ufone gives many more reasons to smile to its customers. It has a customer base of 20 million and its network coverage is in about ten thousand different locations. Ufone's slogan 'It's all about U' is a promise to its customers to stay ahead of all and providing everything considering their needs and convenience. Ufone understands the value of its customers and the importance of words so it makes sure whatever it promises to its customers, it communicates it effectively and efficiently. Like the first company, Ufone was also studied with respect to two of its departments, marketing and sales. So informant 1 is from the marketing department who has contributed to the advertising and overall decisions regarding different marketing campaigns. Informant 2 from the sales department has been selected to provide information regarding the revenues and sales and their relation with the various advertising campaigns. Ufone's ad team has received a lot of praise lately and it seems that it never runs out of new and innovative ideas.

Over the last few years it has been able to capture a wide loyal audience who looks forward to their every new commercial. Not only the loyal customers, everyone enjoys the humour in their TVCs. The commercials are such that they do not let audiences' lose interest till the very end. The way the message is conveyed is fun yet clear. All the credit goes to the excellent brand team for being brave enough to be different, creative and adventurous.

4.7 Interview details

The officials from all the companies were very cooperative and did not hesitate in sharing their experiences. They gave a very honest and direct response regarding each advertising campaign of their company. Although not much confidential or private information was required for this research from the respondents, still they were very understanding and communicated well. This was probably because of the research purpose being explained to them in the beginning and they also found this research topic to be quite interesting because it is different from the typical research done on telecommunication companies.

There was no deviation observed from what was said in non-verbal language. This applies to all two companies being studied and interviewed.

The first interview at Warid was with the marketing official who gave us information regarding 5 advertising campaigns and the teams behind them. The first question was regarding their first advertising campaign and how did it prove to be effective or non-effective for the organization. The informant told us about the very first T.V ad of Warid which was based on the song "Jhoomo ray sawan aayo". It was a one minute ad which portrayed six different situations with a very catchy tag line describing each one of the situations.

Each situation with the same song in the background gave a very emotional appeal to the ad. The first situation being portrayed in the ad was of a marriage ceremony, the second showed a teacher dancing in rain with her students, the third portrayed a few elderly men enjoying life to the fullest by jumping into a pool with youngsters, fourth featured the spirit of cricket enjoyed by every individual from every field, the fifth

showed ladies having a pillow fight and the last one showed two kids enjoying life in their own way. This ad catered to every age group and had an emotional appeal along with some very catchy descriptions showed by text for every situation. These descriptions included; 'Be loved', 'Be inspired', 'Be young', 'Be spontaneous', 'Be one with 145 million people' and 'Be heard'. The informant told us that this first ad of Warid was the one that was given a lot of thought and time. It had a diverse team behind it.

All the ideas for different situations came from different individuals in the team and together these ideas resulted in this beautiful depiction of life. This attracted a wide base of customers and captured attention towards this brand.

The second question was about the goals and aims expected to be achieved through every ad. The informant told us that every ad is not made with the same purpose of increasing sales. Every ad has a different goal behind it, sometimes it is increasing sales, sometimes it is changing the brand perception and image, sometimes the purpose is to introduce new services it offers or just creating awareness and attracting more customers and making them switch to this brand by communicating the competitive advantage. The next question was about another ad that gained a lot of popularity for the brand in terms of its internet packages. This was Warid edge ad that was simple yet conveyed its services and offers so well that every viewer could understand the benefits of switching to this brand. This ad featured a famous Pakistani male model named Imad Irfani. When asked about this commercial, the informant told us that not much creativity was required for this ad so the team behind this was not given much consideration.

A simple team was chosen to design this particular marketing campaign because the major purpose of this was to create awareness about Warid's internet services. That was probably the reason why not a huge or diverse team was chosen for this purpose. All the individuals in this team were of the same age group. Another T.V commercial that gained popularity was the one featuring Pakistani female model Tooba Siddique. This was 'Warid bol anmol' ad that focused on the bonuses provided by use of Warid. This ad was an informative one but had a little emotional appeal to it towards the ending of the ad. The informant was asked about the idea behind this ad and the purpose behind it. He told us that this ad was created at a stage when Warid has gained a sufficient amount of popularity and this ad was basically created in order to attract more customers by providing them with information about the various benefits of using this brand. Again not much creativity was required for such a simple idea. Still a lot of thought was given into it but the design team thought it was best to keep it simple and sophisticated which would create an impression of a very sophisticated and mature brand. The team behind it comprised of 4 members who came up with this idea. The model was chosen because of her popularity and sophistication that was supposed to be the theme for this ad. The next question was about a very famous ad that gained popularity because of featuring Pakistan's biggest actress and celebrity Reema Khan. The informant told us that this ad was created at a time when Warid had become one of the top brands in telecommunication networks and there was a need to renew the brand by bringing in something new and interesting to capture attention of audiences. For this particular reason a young and energetic team of designers was chosen.

The purpose for this particular advertising campaign was made clear to them. That is the reason for the success of this ad. The team comprised of young females and males. They decided upon bringing a big celebrity to promote this ad and the emotional appeal to this created all the more interest and loyalty towards the brand. Till now this ad has proved to be one of the most successful ones in terms of meeting the required goals for it. The last question was about Warid's regional campaign that featured a very popular song of Najam Sheraz 'Ye sheher ye hain hamare'. The informant told us that the reason behind creating this ad was to communicate the maximum popular offers and services of Warid in the minimum amount of time in the form of a T.V commercial. The commercial was a brilliant effort by the team to portray the rich culture of Pakistan and the diverse lifestyle of its people. The team behind this ad also comprised of young professionals who belonged to different regions of Pakistan. Each had a different idea of portraying the culture of their region. The basic theme agreed upon was the result of the diverse ideas by each individual in the team. This resulted in a beautiful depiction of Pakistani culture that created an emotional attachment to the brand and the audiences loved the song and the video.

The second interview in Warid was with the sales official. He gave an insight into the results of various marketing/advertising campaigns and how they generated revenues for the company. The first question was about the relation of advertising and marketing with the sales. Informant two told us that not every advertising/marketing campaign results in an increase in sales or revenues for the company.

Only those campaigns that are specially designed with the aim of increasing sales are the ones that affect sales. But it is not always the case. Sometimes the campaigns designed just to change brand image and increase popularity also result in an increase in sales. That according to him is basically due to the huge impact of the advertising campaign on the audiences. He told us that there is a strong relation between advertising/marketing campaigns and sales. The second question was about the ads that generated maximum amount of revenues for the company. The informant told us that all the ads having emotional appeal and popular celebrities were the ones that generated maximum amount of sales and revenues. Some of those influential ads included Warid's first commercial that resulted in the initial popularity, strong brand identity and image. It was the result of this ad that the standards were raised so high that every ad was expected to deliver something new and was expected to connect to the audiences. He told us that out of the five ads being studied, the most influential in terms of an increase in sales was the one that was part of Warid's regional campaign. This increased the sales of Warid in the sense that it spread geographically. This huge spread in different areas of Pakistan included small towns and villages too. When asked about the result on sales because of the most famous commercials featuring popular celebrities, the informant told us that they were beneficial for the company not in terms of an increase in sales or revenues particularly but in terms of meeting their desired goal which was increasing brand awareness, creating brand popularity and attracting audiences with an emotional appeal. This affected sales to some extent but not particularly the ones that had a huge impact on sales.

The second interview was with Ufone's marketing and sales officials. This interview was expected to be very informative because of the huge popularity of its advertising campaigns. The clutter-breaking ads are of huge interest to almost everyone. Informant one at Warid was from the marketing department. The first question was

about the switch in theme of its advertising campaigns and the purpose behind it. Informant one told us that advertising is all about creativity and tactics. What creative strategy you choose to adopt determines what the message is going to say and how. He told us that on out of five TV ads follow humorous appeal. This appeal has recently been used a lot worldwide. It is not at all an easy task to use this appeal because sometimes they fail to raise a laugh. In our part of the world, humour in advertising is not very common. There are a few brands that have been successful with the use of this technique and Ufone is one of them. It has managed to create an impact on the minds of the audiences. The second question was about the person behind this change and innovative ideas. The informant told us that person to introduce humour in ads of telecommunication sector was Asher Yaqub. He is considered to be a marketing genius. He started off with Ufone where he proved himself to be an important team player. Being the marketing manager of Ufone, he was the first one to use the technique of humour in ads of Ufone. Faisal Qureshi, Adeel Hashmi, Meekal and Mehreen Raheel are important members of the team that helped in translating the innovative ideas on screen effortlessly. The third question was about the huge change seen in the advertising about three years back.

When investigated about the reason behind it, the informant told us that in 2008, Ufone was going through a bad phase in terms of its network problems and marketing. It was losing its market share. The marketing guru Asher had left the company but he was brought back as chief marketing officer. Again he made use of his vibrant ideas and took the brand to great heights. So he was the reason for this huge change. The next question was about the most famous commercial of Ufone till now. The informant told us that Ufone Saaf Awaaz commercial has been the most popular till now. This was the one commercial that got most viral and helped in improving the company's image and position. This ad came on air in 2010 with the same team lead by Asher. The next question was about the Ufone rich boy ad that also aired in 2010. This ad according to the informer did not manage in getting as much popularity as the 'Saaf Awaz' commercial. Still this carried on the attraction of audiences to Ufone's commercials and entertained them. However, because of the monotonous approach and humorous advertising, Ufone has been losing on its customers such as corporate customers. The next question was about the Ufone's Ramadan commercial of 2009 that also had a humorous appeal t it. The informant told us that the team behind this ad was the same and so were the actors and director. The basic upturn was caused by the 'Saaf awaz' commercial only and this one along with a few others was just an extension to the brand's projection of a humorous image. Another ad that was investigated about was the 'Mummy ad' that featured the same actors and followed the same appeal. The informant told us that even after Asher left Ufone, the company has been using his technique and ideas. Even now every ad is an extension of his ideas. So this ad was also based on his concept followed by the same team. The last question from informant one was about the ad of 2011 that focused on ladies package and featured popular male model Meekal and new female model Ayaan.

The informant told us that this ad following the same theme proved to be a little different because of the use of a different female model this time. The female model was chosen because of her immense popularity growing suddenly. The theme and team still remained same. But this ad was successful in terms of creating awareness about the ladies package. This helped in achieving the goal very successfully.

Informant two from the sales department was asked about the difference in statistics of 2008 and 2009 when the company started making a change in its advertising. The informant from the sales department told that there was a huge increase in sales during the year 2008 and the first 6 months of 2009. Not only did Ufone provide positive financial results, it also helped in grabbing a huge customer base. The next question was about how Ufone's financial position has improved as a result of different advertising campaigns over the years. The informant told us that advertising has been a major factor in affecting the sales and financial results for the company. It had a huge impact on the audiences and many young people switched to Ufone as a result of the catchy humorous commercials. The only decrease seen after this change in advertising technique was a decrease in corporate customers who found these commercials monotonous and lame and did not match their needs and personality.

The next question was about the advertising campaign that had the most impact on sales. It was quite obvious from the popularity but still the sales official confirmed that the major attention grabbing commercial 'Ufone saaf awaz' was the one that not only changed the brand's personality but also generated sales.

4.8 Empirical research results

For the analysis of data collected through interviews, it was divided into three different parts: the data relevant to research questions, data irrelevant to the research and general descriptive data of participants and experience. The empirical study has contributed to the development of the research field in a way that the topic of mental models is least touched upon, even if it has it is usually more focused towards the study of mental models related to design of products. This study will help advertising organizations and motivate researchers to work more related to the topic in relation to the advertising environment.

- *What is the mutual influence of mental models of participants in co-design?*

The mental models of participants in a team affect their knowledge and understanding of the situation. Every individual has a different mindset, knowledge and understanding of the problem. During the process of designing an advertising campaign, both companies choose a team that they think is efficient enough to fulfil the aim of that particular campaign. In the designing process, every individual is given a sense of ownership, with the spirit of taking pride in the team and its output. With that ownership, comes the spirit of sharing their knowledge and coordinating with each other. The acceptance of ideas of everyone and integrating to form a solution is what makes the process of co-design efficient. When everyone in the team comes up with their own ideas and solutions, there is a greater chance of coming up with an innovative design. The mental model of one individual restricts his/her actions and thinking, but when everyone's mental models coordinate and adapt to each other with the spirit of working as a team, this is where innovation and creativity comes in. The minor details that one individual might ignore can be of utmost

importance to another team member. So there is a lesser chance of small things being ignored that might have significant influences on the overall design.

- *How do mental models of individuals in a team coordinate and adapt to have an effect on performance and efficiency of the design process?*

The performance of individuals in a team and their learning process is improved as a result of sharing their knowledge and understanding, which is a result of good coordination among team members. The understanding of goals and aims of a particular task for an organization is highly important. Ufone, in its years of downfall had the aim of changing the brand image with the major purpose of improving its sales. It was then that it wanted a team of professionals that could come up with such innovative ideas that grab attention of customers once again to the brand. The team they hired was creative, diverse and understood what the goal is that the organization wants to achieve through them. The efficiency of their design process was the result of good understanding and coordination among team members. The better the coordination among team members and the ability to adapt to each other's mental models, the more efficient the design process is. The efficiency of design process automatically leads to a better performance in terms of team and the organization.

- *What is the relationship of convergence in team members' mental models and content of shared mental models with team performance?*

The content of shared mental models is of extreme significance since it is what affects the design process. The content of shared mental models is based on the mental models of individuals which leads us to the fact that the characteristics of each individual's mental models are very important. As much as the content of mental models is important, the convergence in mental models of team members is important. The convergence is important but after the content of mental models of participants. The reason for that is, if the content is not good enough and is unable to provide a relevant solution or good design, the convergence would lead nowhere. That is probably the reason why diversity in a team is so important and so are the characteristics of mental models of team members. The convergence is more important in the later stages of design process.

5 ANALYSIS AND RESULT

The comparative analysis will be based on the research questions. Three research questions have been studied and the theoretical and empirical studies have helped in answering them. Some related themes regarding the research topic have been highlighted. The comparative analysis aims at identification of the emerging themes by comparison of theoretical and empirical studies.

Same data collection techniques and data analysis techniques have been used that discussed in chapter 2 in order to provide answers to all questions.

5.1 Analysis

The frame of reference recommended for the comparative analysis is relevant to the research questions that support the research objectives. Three research questions have been addressed in the theoretical and empirical studies. The goal of theoretical study is to create a perception of mental models from prior research in the related fields of study. The empirical study aims to study two different organizations with the data being gathered through detailed interviews. The comparative study helps in identifying evolving themes by comparing both the studies. The mental models of participants in advertising design teams in two organizations have been investigated.

- *What is the mutual influence of mental models of participants in co-design?*

Data was provided from two different organizations, analyzing a total of ten campaigns. The qualitative data was derived from the answers received through interview. The sales department rated each of the promotional campaigns in terms of their set goals. Every campaign has its own different goals or aims. The effectiveness of campaigns was told by the officials from sales department. The effectiveness of each campaign was not only analyzed in terms of benefit-cost ratio but the targets it wants to achieve through it. This information was also given by marketing officials of both companies. They had a better idea of those campaigns whose purpose was not just generating sales and revenues. They told about each campaigns purpose and how well it managed to achieve them. Since mental models is the dependant variable so details regarding the design team for advertising campaigns was required which was provided by the informants from marketing department. All this data was generated by personal interviews with officials from both departments of each company. The marketing officials provided us with all the information of the teams behind each promotional advertising campaign.

- *How do mental models of individuals in a team coordinate and adapt to have an effect on performance and efficiency of the design process?*

The content of shared mental models has been found to affect the efficiency of design process. Both organizations had their ups and downs as a result of different advertising campaigns. It may not be possible to develop strategies of teamwork that

are equally applicable for stakeholders in co design process. But general recommendations and strategies can be applied based on specific project requirements and under the required conditions for the specific project. Through their experience they have concluded that for every advertising campaign's design there are different needs of the team. Some teams need to be extremely diverse; some need to be more experienced and so on but the efficiency of design is seen to be more affected by the diversity in team members because that leads to creativity in problem solving. The more the diversity in individuals in a team, the more will be the difference in mental models of team members.

- *What is the relationship of convergence in team members' mental models and content of shared mental models with team performance?*

Most of the teams behind successful advertising campaigns had some common characteristics in their mental models. These included diversity and level of education. The difference in team members' mental models is what makes shared mental models so significant. The shared mental models lead to a better learning, sharing of knowledge and ideas. The best advertising campaigns of both the companies have been those behind which there was a diverse team rather than a more experienced one. Young, diverse team of designers was able to come up with a creativity that yielded better results than an experienced group of professionals could. The reason for that is that their mental models have been shaped in similar and a particular way due to their experiences. Coordination and adaptation of team members' mental models is of more significance and yields better results than that of an experienced group. The best advertising campaigns are the result of convergence of mental models of diverse team members. The knowledge of team member might be overlapping or complementary. The best results are achieved when the diversity in a team occurs in the sense that two individuals work in the same industry or organization but different fields/department. That is usually when they have overlapping knowledge which is of great significance to the design process. Different views are extremely useful in broadening views when it comes to designing or performing complex tasks.

5.2 Result summary

In researching the concept of mental models in co-design, a theoretical study was conducted with regard to previous literature. In addition to that an empirical study related to two organizations in the telecommunication industry was conducted. A comparative analysis was done between the results from both the studies. The comparison was done on the basis of research questions.

- Theoretical study has suggested that the longer the team members work together, the better the understanding and coordination among them. Their mental models coordinate and adapt to each other better. Despite this, diversity among stack holders leads to more creativity and innovation. The

more different and creative concepts come from different minds, the less is the chance that any important aspect will be overlooked.

The qualitative data for the empirical study was derived from the answers received through interview. The sales department rated each of the promotional campaigns in terms of their set goals. Every campaign has its own different goals or aims. The effectiveness of campaigns was told by the officials from sales department. The effectiveness of each campaign was not only analyzed in terms of benefit-cost ratio but the targets it wants to achieve through it. This information was also given by marketing officials of both companies

The analysis of question one enforces that mental models of participants in a team make them act according to their predictions, understanding and knowledge of the task and situation and their coordination and influence on each other leads to better planning and better problem solving hence improving the co-design process.

- The theoretical study provides some relevant information regarding the variables of mental models. Some of the variables considered to be significant include education and experience. Diversity in a team has also been found out to be significant variable that improves the design of products or service.

Through the empirical study it has been found out that the need for each advertising campaign is different. Some require more experience, some require more diversity and some require more education the related field. Both the organizations under study agreed that efficiency is increased by more diversity in teams because that leads to creativity in problem solving. The more the diversity in individuals in a team, the more will be the difference in mental models of team members.

The analysis of question two proves that adaptation to each other's mental models in a team and coordination among members is the result of sense of ownership and responsibility in team members by the organization, which improves the efficiency of design process along with the performance of design team.

- Theoretical and empirical study has suggested that greater convergence in mental models of team members leads to better performance and better problem solving.

The analysis of question three illuminates the results found in both theoretical and empirical studies which are consistent with each other. There is a direct relationship between convergence in team members' mental models and team performance. But the content of shared mental models comes first in the design process that affects team performance more.

6 DISCUSSION

6.1 Conclusions

The concept of mental models is a phenomenon that has gained momentum in the last few years due to an increased use of mental models in designing computer software and team work in organizations. The organizations becoming more dependent on diverse teams have led to an interest in the concept of shared mental models; how they have an effect on team efficiency and problem solving.

The thesis aims to identify the important factors that affect quality of mental models in co-design. It was composed of theoretical and empirical study that generated answers to the three question questions. In theoretical study, the concept and foundation of mental models is present with respect to individuals more than teams. But since individuals form a team, it is expected that each member's mental model affects, coordinates and adapts to other's mental models; hence proving the importance of shred mental models for teams. The factors affecting quality of mental models in a team in significant because it has an impact on the overall design process.

The diversity in a team leads to creativity and better problem solving. It is very important to determine which members have chosen in a team for a particular task because if they have the same mental models, they will have a limited approach to things. The characteristics that have an effect on mental models of members in a design team include diversity, knowledge/education and experience. As much as the knowledge of every individual in a team is important, the sharing of that knowledge with team members is also important. Every individual's judgments and understanding is a result of his/her knowledge and level of education. It is not important that an individual with higher level of education is the one who will benefit a team. It depends on his knowledge of that particular task. Experience along with education shapes most of the mental models. Experience has a lot of contribution in shaping a person's mental model. Sometimes experience plays a better role than knowledge in helping understand a situation. So experience is a factor that has been found out to improve quality of mental models through accuracy. It is important for an organization to choose that team which fulfils its required goals from a particular task and secondly which has good quality mental models.

6.2 Implications for Informatics

The concept of mental models can be applied to the field of informatics. Mental models help in understanding human behaviour. The study of mental models tells how an individual will perceive a certain thing. Study on this topic can help in designing of computer software and information systems. If the mental models of individuals are studied in detail and understood, it would give a clear view of how he perceives different things and that is how the systems can be designed keeping in mind the user. Different computer software companies can make use of this study.

6.3 Method evaluation

The theoretical study helped in exploring relevant text regarding the concept of mental models in co-design. The text that was used in literature sampling included articles published in academic journals and textbooks. That text helped in providing a research purpose. The relevant findings of that text were applied to research questions. The analysis of the text varied with the perspective. There were times when the analysis of different articles varied probably due to the difference in time and the difference in interpretation of the concept.

The text related to this topic that was read proved to be very beneficial in understanding the basic concepts. It also provided with the topics that have been researched in history and the ones that have not been given much importance but are relevant to organizations. The text analysis was very useful in generating relevant information regarding this topic and helped a lot in understanding various aspects of this research.

The tool used for collecting data for this research was detailed interviews. This was the best choice for gathering empirical data for this research because nothing else would have generated such accurate data than the sales and marketing officials themselves. Only they have such accurate and detailed information regarding their teams and the experiences generated as a result of designing different advertising campaigns. Questionnaires would not have been a good option since they would have limited the information and also the whole experience of interviews helped in generating more detailed information which would have not been possible with any other means. The interview experience was very pleasant and luckily not much problems had to be faced. In fact it provided with such information and details regarding advertising of telecommunication sector that are not understandable without actually talking to someone working there. The concept of such companies and their work environment is quite different from the reality.

6.4 Result evaluation

- i. The data collection method consisted of in depth interviews. Live interviews were taken in both the organizations under study. They have the advantage of validate reliability and truthfulness. The informants were contacted in person. The informants were asked the questions directly by the researcher. The methods used were legal and ethical. All the people directly or indirectly related to this research have been treated with respect, their intellectual property rights have been well taken care of and the rights of informants have been maintained. Ethics have been followed at every stage of this research.
- ii. The organizations under study fits the criteria of this research since they depend a lot on their teams for designing of advertising campaigns and focus a lot on team work. The informants interviewed possessed the detailed knowledge of their field and also had an understanding of this concept under study. The informants interviewed from both the organizations were the sales and marketing officials. The data sources were found to be consistent at

different points in time and in different settings like private and public. No difference was found in viewpoints of both the informants of each organization. This proves that the research data was collected from reliable individuals.

- iii. The data was not analyzed by different researchers. Multiple perceptions could not be taken into account for the purpose of analyzing the data.
- iv. The research results will be applicable across a given population but the implications for generalization might be explored through sampling.

6.5 Possibilities to generalize

The results can be well applied to advertising companies, telecommunication sector but not only that. Broader inferences can be drawn that are relevant outside the given study. It is usually hard to generalize qualitative research but some aspects can be applied to all organizations specially the ones that focus a lot on team learning and teamwork. The knowledge generated as a result of this thesis is related to the psychological aspect of teamwork in organizations.

6.6 Ideas for continued research

The study of the concept of mental models is very dynamic. Many small aspects of this study can be undertaken as separate topics. The ideas for continued research include: Team Learning and building shared mental models, relevance of mental models in reasoning, use of mental models in training, development and evaluation, use of mental models in entrepreneurial activities, gaps in mental models and the need to change mental models in HR (Human Resource).

6.7 Speculations for the future

There is a bright possibility that a trend might emerge in organizations in future that makes use of mental models for not only co-design, but also training and development of employees.

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8 APENDIX

INTERVIEWS QUESTIONS

WARID:

INTERVIEW WITH THE MARKETING OFFICIAL:

1. What was your first advertising campaign and what were the results?
2. Tell us about the team behind the 'Warid Edge' ad that featured Emad irfani. What was the goal that your organization wanted to achieve through it?
3. What was the idea and purpose behind the 'Warid Bol Anmol' ad that featured the famous model Tooba? What was the team behind it?
4. Do you think that the ads featuring celebrities like Reema Khan prove to be more effective than others? Who generated the idea of taking her as a model for your ad? Who was the team behind the idea?
5. What was the aim and team behind the Warid's regional campaign that featured a very popular song of Najam Sheraz 'Ye sheher ye hain hamare'?

INTERVIEW WITH THE SALES OFFICIAL:

1. What is the relationship between advertising/marketing and sales of your company?
2. Which advertising campaigns generated the maximum amount of revenues for the company?
3. Which advertising campaign has been the most influential in terms of sales?
4. Do you think that the advertising campaigns featuring popular celebrities have a greater impact on sales and revenues for the company?

UFONE:

INTERVIEW WITH THE MARKETING OFFICIAL:

1. A sudden change was seen in the theme of your advertising campaigns. Please comment on the reason behind this shift?
2. Who is the team or individual behind the innovative ideas of your humorous advertising campaigns?
3. What was the reason behind the huge change in your advertising theme and strategy seen about three years back?
4. Which Ufone commercial has been the most popular till now?
5. What was the team behind the Ufone rich boy ad that aired in 2010?
6. Who was the team behind the Ufone's Ramadan commercial of 2009 that also has a touch of humor?
7. Kindly comment on the team and the aim behind the 'Mummy ad' that featured the same actors and had the same appeal to it?
8. What were the team and the idea behind the ladies package ad of 2011 featuring models Ayyan and Meekal?

INTERVIEW WITH THE SALES OFFICIAL:

1. What was the difference in statistics of 2008 and 2009 when the company started making a change in its advertising?
2. How has Ufone's financial position improved as a result of different advertising campaigns over the years?
3. Was there any disadvantage seen in terms of sales after the switch in advertising theme?
4. Which advertising campaign/campaigns had the most impact on sales?

University of Borås is a modern university in the city center. We give courses in business administration and informatics, library and information science, fashion and textiles, behavioral sciences and teacher education, engineering and health sciences.

In the **School of Business and IT (HIT)**, we have focused on the students' future needs. Therefore we have created programs in which employability is a key word. Subject integration and contextualization are other important concepts. The department has a closeness, both between students and teachers as well as between industry and education.

Our **courses in business administration** give students the opportunity to learn more about different businesses and governments and how governance and organization of these activities take place. They may also learn about society development and organizations' adaptation to the outside world. They have the opportunity to improve their ability to analyze, develop and control activities, whether they want to engage in auditing, management or marketing.

Among our **IT courses**, there's always something for those who want to design the future of IT-based communications, analyze the needs and demands on organizations' information to design their content structures, integrating IT and business development, developing their ability to analyze and design business processes or focus on programming and development of good use of IT in enterprises and organizations.

The **research** in the school is well recognized and oriented towards professionalism as well as design and development. The overall research profile is Business-IT-Services which combine knowledge and skills in informatics as well as in business administration. The research is profession-oriented, which is reflected in the research, in many cases conducted on action research-based grounds, with businesses and government organizations at local, national and international arenas. The research design and professional orientation is manifested also in InnovationLab, which is the department's and university's unit for research-supporting system development.



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