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Paradigms Shift in Physics Education through Naturalistic and Ethnographic Research

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Abstract. This paper attempt to offer paradigms Shift in Physics Education through Naturalistic and Ethnographic Research. This paradigm is a qualitative research method which it is a metaphorical study. Take advantage of cultural concepts as the main idea for explaining and interpreting the results of the study. We offer the notion of implementing naturalistic and ethnography for Physics Education research. The current study is a content analysis of research in Physics education. Giving an example of Naturalistic and ethnographic research in physics education. Planning naturalistic and ethnographic research. This paradigm is a beautiful and interesting paradigm. As another way to do research in another form for those who want to gain insights into physics education. To provide teachers with guidelines for teaching learners in different societies and cultures.

Keywords: Physics Education, Naturalistic and Ethnographic Research, Research Paradigms

INTRODUCTION

Naturalistic and ethnographic research [1] is a qualitative research method which studies phenomena from the perspective and definition of the people involved in the phenomenon. focusing on natural phenomena Social and cultural phenomena based on the principles of understanding things, whether it is values, ideas, beliefs, views from the perspective of people in that society. It is not a test of the researcher's hypothesis. Focuses on collecting information as details of a specific sample. The data were then analyzed by interpreting and correlating human actions. using a variety of data collection methods. Anyone can do this Paradigms of research because everyone has their own naturalistic and ethnographic.

Paradigms in Physics Education Research [2], the information about the research methods of physics education research that was reached through the databases of ULAKBİM and EBSCO between the years of 2008 and 2013. The findings show that the researchers primarily used the quantitative method (55.24%), secondarily used the qualitative method (37.14%) and thirdly used the mixed method (7.62%). According to research, most of the research in physics educations research are used quantitative form. Natural and ethnographic research is a qualitative research method. It is interesting and should encourage the researcher to do it. In order to be a guideline for teaching and learning in accordance with the social and cultural context of the learners.

In this paper, a research approach in the form of Naturalistic and Ethnographic research for Physics Education. It is primarily a metaphorical study. There are various data collection processes. To obtain sufficient information to answer research questions. To understand ethnographic research methods which is considered a research method that is appropriate to study the cultural context. When looking at the picture of research methodology, it is often interpreted in a social or anthropological sense. But education context or sciences education phenomena, this research methodology can be applied to Study in depth specific information or phenomena that cannot be collected by

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quantitative methods. such as the study of concepts, beliefs, values, or the acquisition of individual knowledge, etc. These variables require an ingenious method of collecting data. And the researcher is the most important tool in research for to get information that is accurate and truly reliable.

NATURALISTIC AND ETHNOGRAPHIC RESEARCH

Naturalistic and ethnographic research [1] is used by many educators by different names, for example: Field Studies, Field Work, Naturalistic Inquiry, Ethnography, Ethnographic Research, etc. This research is a qualitative research method which studies phenomena from the perspective and definition of the people involved in the phenomenon. focusing on natural phenomena Social and cultural phenomena based on the principles of understanding things, whether it is values, ideas, beliefs, views from the perspective of people in that society. In order to this paradigm of research is well, the researcher should have an understanding of the sample to be studied and participate in the story that we are going to study, explain and interpret. Take into account the way of seeing in paradigms of Naturalistic and ethnographic research. Describe a story from where we view an event and what we see in it.

Ethnographic "Ways of seeing" [3, 21, 22, 23, 24] involves more than merely describing people, places, activities, institutions or event. Ethnographic is a "Way of seeing" that involves the study of culture and of the interpretive framework that ethnographer imposes on whatever they study. No field researcher can be a completely neutral, detached observer, outside and independent of the observed phenomena [5]

Generating Meaningful Data. Ethnography may involve a range of research practices and techniques: observation of people, places and events, participation in activities and informal conversations, interviews with individuals or groups, gathering artifacts, images and texts that relate to a particular research site, taking photographs or videos of activities and events, and working with policy documents and public data to shape a fuller picture of the research context.

Points for discussion. Setting the scene; background information; significant people and places in the research site; details through which a 'sense of place' can be communicated. Sequencing: keeping track of research dates and events in the field notes; recording events in logical or chronological order where possible; keeping an eye out for the 'back story' to significant events. Jotting: can be invaluable for noting down key moments or comments; may use abbreviations, symbols, diagrams, or very brief notes that will be written up in detail later. Conversations: distinguishing between direct and indirect quotes; often recalled and written down after they occur. Characters and relationships: documenting information that describes participants fairly and accurately, without identifying them; noting relationships between participants; noting how relationships or individuals' impact on events. Voice recordings: a digital voice recorder or mobile phone with a recording function can be useful for recording information while you are travelling home from a research site, you can then listen to the recording as an additional aid when writing up fuller notes. Inclusions and exclusions: deciding which details are necessary and which are superfluous; recognising whose views are represented, foregrounded, or privileged by participants within the research site; recognising whose views are represented, foregrounded or privileged by you as researcher. Episodes: may be documented with more detailed notes as they occur or may be recorded with jotting and filled in later; drafting episodes require time and critical reflection. Questions: questions you may need to ask participants in order to clarify your understanding; questions that emerge for you while you are conducting the study that you want to explore in greater detail in your analysis.

PHYSICS EDUCATION RESEARCH

Physics is one of the three core sciences of pure science that is indispensable to the development of new technologies, causing many countries to pay attention to the development of physics teaching. In addition, physics is the subject that most students face with the most problems. Because most of the content is quite abstract. use math as a language make it difficult to understand Physics is therefore a challenging subject in terms of both learning and teaching. But physics is an important body of knowledge for developing workers to have the knowledge and skills necessary to compete in the knowledge-based society. Therefore, raising the quality of science learning, especially physics in Thailand, is essential. To increase Thai workers who have the potential to join in driving industry 4.0 economic model that focuses on driving the country through innovation, technology, and creativity. Throughout the past forty years, Research results in Physics Education have helped to improve the teaching and learning of physics in the United States, Australia and European countries. to be more suitable for the learning nature of the learners. And the results indicated that before studying physics, students understood physics phenomena in daily life. But most of

this understanding goes against the principles of physics, which is called misconceptions. which is caused by the students creating naïve model. to explain the phenomena encountered in everyday life and gradually take root into a misconception. which teaching by lecture alone cannot correct these misconceptions. Physics educators and researchers at school and the higher education level recognize the importance and long-term effects of this problem. Therefore, a research system was initiated to develop curricula and teaching techniques by focusing on the results of research in physics education to design a course teaching materials that emphasizes teaching techniques based on active learning. To make students center of learning. Emphasis is placed on hands-on and analytical thinking during physics lessons. To enable learners to open their minds to create a correct understanding of physics content.

Consider paradigms in Physics Education Research [2, 15, 16, 17, 18, 19, 20]. The information about the research methods of physics education research that was reached through the databases of ULAKBİM and EBSCO between the years of 2008 and 2013 could be seen in Table 1. The findings show that the researchers primarily used the quantitative method (55.24%), secondarily used the qualitative method (37.14%) and thirdly used the mixed method (7.62%).

TABLE 1. The research methods of the examined studies

Research Methods	f	%
Quantitative	58	55.24
Qualitative	39	37.14
Mixed	8	7.62
Total	**105**	**100**

From table 1 they can distribute physics education articles according to their research titles that were reached from the databases. It is so obvious that the teaching methods dimension is one of the most concentrated dimensions (34.28%) in the research of physics education. After the teaching method dimension, cognitive dimension (19.15%), emotional dimension (12.38%), assessment and evaluation dimension (12.30%), physics teacher training programme dimension (11.42%), education technology dimension (8.57%) took place.

TABLE 2. The distribution of studies examined between the years of 2008 and 2013 according to their research titles

Research Methods	**f**	**%**
Emotional Dimension	13	12.38
Cognitive Dimension	20	19.12
Success	2	1.92
Education Technology	9	8.57
Teaching Methods	36	34.28
Physics Teacher Training programming	12	11.42
Assessment and Evaluation	13	12.30
total	**105**	**100**

From the current trend of research in physics education. Most of the research is done in Teaching Methods and is a quantitative research paradigm. There is almost no research on Naturalistic and ethnographic at all or in some research there may be a similar format to research in Naturalistic and ethnographic. But it still cannot be identified as this type of paradigm. The next section will be an example of research in physics education in a qualitative paradigm. similar to studies in the Naturalistic and ethnographic research in physics education.

NATURALISTIC AND ETHNOGRAPHIC RESEARCH IN PHYSICS EDUCATION

There are many qualitative research in physics education that have a Naturalistic and Ethnographic research approach. However, it is not yet clearly identified as this paradigm of research. For example: the science technology society research the nature of science research, etc. In this topic, research is presented in a paradigm study that can be

a natural paradigm. Namely 'I loved exploring a new dimension of reality' – a case study of middle-school girls encountering Einsteinian physics in the classroom [5] and "I am a young immigrant woman doing physics and on top of that I am Muslim": Identities, intersections, and negotiations [6].

'I loved exploring a new dimension of reality' – a case study of middle-school girls encountering Einsteinian physics in the classroom written by Magdalena Kersting, Gretchen Schrocker & Sandra Papantoniou (2021) [5]. The purposes of the research are (1) What are the qualitatively different ways in which middle-school girls experience Einstein's general theory of relativity in the classroom? (2) How does encountering Einstein's general theory of relativity in the classroom influence middle-school girls' perception of and orientation to physics? As this research aims to investigate how middle-school girls experience EP in the classroom, we chose an exploratory case study as our overarching method of inquiry [25]. Specifically, we adopted a sociocultural view towards learning and used a phenomenographic lens for analysing middle-school girls experiences of an EP programme with a focus on Einstein's general theory of relativity. Research approach phenomenography. They studied about the exploratory case study addresses this need and adds to our knowledge of how middle-school girls' experience Einsteinian physics (EP) in the classroom. They report on an EP programme run with 39 girls (14–15 years) in an independent day and boarding school in Australia. Based on a phenomenographic analysis of focus group interviews and open ended questionnaires. We document the range of students' experiences of EP. The analysis revealed three categories of description that correspond to a personal, scientific, and holistic way of experiencing EP. These experiences influence the girls' perception of and orientation to physics by increasing interest in physics, challenging traditional stereotypes, and showing future possibilities such as career paths in science. Our findings inform a discussion about improving instructional practices in science classrooms to realise the full potential of EP education. Furthermore, our study adds to a growing body of research that aims to foster middle-school girls' interest in physics.

"I am a young immigrant woman doing physics and on top of that I am Muslim": Identities, intersections, and negotiations written by Lucy Avraamidou [6]. The purpose of the research is attempting to explore the impact of different experiences on Amina's journey in physics, I pay special attention to how her ethnicity, gender, social class, and religion have intersected with her developing science identity. Methods are science identity as a lived experience. This study is framed within a life history or biographical research design, which is situated in cultural historical activity theory [26]. Roth and Tobin [27] argued that by framing identity within the cultural–historical activity theory, identity becomes an outcome of dialectically engaging in practical activity, rather than being an innate property of individuals. This study seeks to illuminate experiences based on the intersectional identities of Amina, a purposefully selected participant, who is currently a physics instructor at a higher education institution in Western Europe. For the design of this study, I chose to employ a qualitative single case study research paradigm to allow Amina to give voice to her own identities and experiences.

PLANNING NATURALISTIC AND ETHNOGRAPHIC RESEARCH

In naturalistic and ethnographic research, the researcher is the most important tool for collecting data. Therefore, the researcher must be prepared for conducting research, including preparing the researcher in terms of knowledge, theories, concepts, principles Preparation of tools and aids for data collection in conducting research. There are usually several approaches in this paradigm. More specifically [7] suggests that naturalistic researchers should address the stages of watching, asking and reviewing, or, as he puts it, experiencing, inquiring and examining. In naturalistic inquiry it is possible to formulate a more detailed set of stages that can be addressed [8][9][10]. In this paper, Cohen [1]'s approach to conducting research in naturalistic and ethnographic paradigms has 11 stages as follows:

Stage 1: locating a field of study. [10] It is a research question which is a qualitative research question. They propose that research questions are formulated in situ and in response to situations observed, i.e. that topics are investigated in all their complexity, in the naturalistic context. So in the context of physics education, we might set up research problems based on what we want to know in the classroom and define the role of the researcher.

Stage 2: addressing ethical issues. Because of this kind of research, we must do research with humans. Therefore, ethics in human beings are important. We must study and follow the rules correctly.

Stage 3: deciding the sampling. Selection of samples in ethnographic research Starting from the idea about the desired data, what would the meaning of this sample be if selected in the data? and what will that information provide in understanding the issues studied? In short, the researcher had to answer the question of why the sample (community, situation, phenomenon, school organization, etc.). The sample is appropriate for the purpose, objective, research question. and how much research conceptual framework.

Stage 4: finding a role and managing entry into the context. This involves issues of access and permission, establishing a reason for being there, developing a role and a persona, identifying the 'gatekeepers' who facilitate entry and access to the group being [9]. The issue here is complex, for the researcher will be both a member of the group and yet studying that group, so it is a delicate matter to negotiate a role that will enable the researcher to be both participant and observer. This stage shows that the researcher is the most important research tool.

Stage 5: finding informants. This involves identifying those people who have knowledge about the society or group being studied. This places the researcher in a difficult position, for they have to be able to evaluate key informants. So the selection and/or relationships with informants is problematical; LeCompte and Preissle [9], for example, suggest that the first informants that an ethnographer meets might be self-selected people who are marginal to the group, have a low status, and who, therefore, might be seeking to enhance their own prestige by being involved with the research. Indeed, Lincoln and Guba [14] argue that the researcher must be careful to use informants rather than informers, the latter possibly having 'an axe to grind'. Researchers who are working with gatekeepers, they argue, will be engaged in a constant process of bargaining and negotiation.

Stage 6: developing and maintaining relations in the field, LeCompte and Preissle [9] suggested that fieldwork, particularly because it is conducted face to face, raises problems and questions that are less significant in research that is conducted at a distance. Therefore, working as a team is very important because the team must help each other.

Stage 7: data collection in situ. The qualitative researcher is able to use a variety of techniques for gathering information. There is no single prescription for which data collection instruments to use; rather, the issue here is of 'fitness for purpose' because, as was mentioned earlier, the ethnographer is a methodological omnivore! That said, there are several types of data collection instruments that are used more widely in qualitative research than others. The researcher can use field notes, participant observation, journal notes, interviews, diaries, life histories, artefacts, documents, video recordings, audio recordings etc.

Stage 8: data collection outside the field. In order to make comparisons and to suggest explanations for phenomena, researchers might find it useful to go beyond the confines of the groups in which they occur.

Stage 9: data analysis. Usually in qualitative research Data analysis is initiated during the data collection process. In practice, qualitative research quickly collects huge amounts of data and early analysis reduces the problem of data overload by selecting significant features for future focus. Miles and Huberman [11] suggested that careful data display is an important element of data reduction and selection. 'Progressive focussing', according to [12], starts with the researcher taking a wide-angle lens to gather data, and then, by sifting, sorting, reviewing and reflecting on them the salient features of the situation emerge. These are then used as the agenda for subsequent focusing. The process is akin to funnelling from wide to narrow. At a theoretical level a major feature of qualitative research is that analysis commences early in the data collection process so that theory generation can be undertaken [9]. The authors advise that researchers should set out the main outlines of the phenomena that are under investigation. They then should assemble chunks or groups of data, putting them together to make a coherent whole (e.g. through writing summaries of what has been found). Then they should painstakingly take apart their field notes, matching, contrasting, aggregating, comparing, and ordering notes made. The intention is to move from description to explanation and theory generation.

Stage 10: leaving the field. The issue here is how to terminate the research, how to terminate the roles adopted, how (and whether) to terminate the relationships that have built up over the course of the research, and how to disengage from the field in ways that bring as little disruption to the group or situation as possible [9].

Stage 11: writing the report. Delamont (1998) [13] notes the shift in emphasis in much research literature, away from the conduct of the research and towards the reporting of the research. It is often the case that the main vehicle for writing naturalistic research is the case study, whose 'trustworthiness' [14] is defined in terms of credibility, transferability, dependability, and confirmability. Case studies are useful in that they can provide thick descriptions that are useful in ethnographic research and can catch and portray to the reader what it is like to be involved in the situation.

CONCLUSION

Paradigms shift in physics education through naturalistic and ethnographic research to make understand the nature of learning physics. Naturalistic and ethnographic research is a qualitative research method. It is a research method that takes advantage of cultural concepts as the main idea to explain and interpret the results of the study. Therefore, the relationship of learning physics with other elements such as social, cultural etc. Very few studies in physics have been identified as Naturalistic and ethnographic research paradigm. Most of the research in physics

education is quantitative research. This makes this paradigm an interesting approach to research to study physics learning by explaining and interpreting cultural concepts into the study. Use participant observation as the primary method of collecting data. In combination with other data collection methods from a variety of sources. The researcher has been in close contact with the people or organizations they studied for a period of time to absorb and understand the way of seeing as well as the opinions of that group as if being a member of the people they studied. That is the researcher uses himself as a tool for collecting data. Meanwhile use every appropriate and feasible method to help reach it. Collect data that fits the most and the best. Example naturalistic and ethnographic research in physics education: 'I loved exploring a new dimension of reality' – a case study of middle-school girls encountering Einsteinian physics in the classroom and "I am a young immigrant woman doing physics and on top of that I am Muslim": Identities, intersections, and negotiations. The two research examples are qualitative research and describe physics learning in social and cultural contexts. Thus, Naturalistic, and ethnographic paradigm research is the storytelling of classroom phenomena in the context of the society and culture of our interest.

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