Chapter II

REVIEW OF RELATED LITERATURE
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INTRODUCTION

Review of related literature is one of the major steps in any research study. It allows the researcher to acquaint himself/herself with current knowledge in the field or area in which he/she is going to conduct his/her research. Best & Kahn (2005) pointed out that review of related literature is a brief summary of previous research and writing of recognised experts provide the researchers familiar with what is already known and with what is still unknown and untested. Since effective research must be based on past knowledge, this step helps to eliminate the duplication of what has been done already and provides useful hypotheses and suggestions for significant investigation (p. 37). The review of related literature paves a clear way for the investigator to present in a proper way to solve the prominent problem. It helps the investigator to form proper objective and hypothesis for the study. It avoids unnecessary duplicity of work.

The chief aim of this literature review is to comprehensively investigate ideas, issues and themes related to the techno-pedagogical and thinking skills of the secondary teacher education students. To achieve this goal, the investigator collected as many studies as possible related to different aspects of the problem under investigation. The studies collected are divided into following subheadings.
(1) Studies on Techno-pedagogical Skills

(2) Studies on Thinking Skills

1. STUDIES ON TECHNO-PEDAGOGICAL SKILLS

(i) Studies Abroad

Teemu, Susanna, Jari, Patrick, Pertti and Stina (2011) conducted a study on confronting the technological pedagogical knowledge of Finnish ‘Net Generation’ student teachers. The study aims to find out “Net Generation” capabilities of 74 first-year student teachers in a Finnish university. The objectives of the study are (i) Net Generation students are adept at learning through discovery and thinking in a hypertext-like manner and (ii) when they enter the teaching profession; members of this generation will be able to transfer these characteristics into their teaching practices. The research is formulated around an extended framework for student teachers' technological pedagogical knowledge. The students designed learning modules incorporating the use of information and communication technology. The learning modules were subjected to document and artefact analysis incorporating concept-driven coding. Supplementary data were collected through a questionnaire concerned with the students' adoption of new technologies.

The findings in the study showed that assumptions about ‘Net Generation’ student teachers' abilities to adopt and adapt ICT in their teaching are highly questionable and that greater attention should be given to the development of their technological pedagogical knowledge.
Tzung-Shi, Cheng-Sian, Wei-Hsiang (2011) conducted a study on integrating web quest with mobile learning for environmental education. The aim of the study was to demonstrate the impact of different teaching strategies on the learning performance of environmental education using quantitative methods. Students learned about resource recycling and classification through an instructional website based on the teaching tool of web quest. There were 103 sixth-grade students participating in this study and broken down into three groups: traditional instruction, traditional instruction with web quest and web quest instruction with outdoors.

The findings in the study showed that: (i) using web quest in outdoor instruction influences students' learning performance positively, (ii) when web quest was used in real situations, students could acquire more knowledge and experiences, and (iii) in the learning activity of the experiment, the students accomplished different learning tasks and expressed their own opinions and perspectives, which could foster their critical thinking skills. On the other hands, the students in outdoor situation could be positive to participate in learning activity; furthermore, they could ponder the learning contents by observing the real context and then they began to classify/categorise the resources.

Brian, Nick and Peter (2010) conducted a study on interactive video technology: enhancing professional learning in initial teacher education. The study aims to find out the use of interactive video technologies to enhance initial teacher education programmes for science trainee teachers. The University of Sussex In-School Teacher Education Project (InSTEP) uses interactive video
technologies to enhance initial teacher education programmes for science trainee teachers. With four Internet Protocol cameras and mounted microphones in both school laboratories and the university teaching room, trainees and their tutors have access to live interaction with schools. InSTEP activities are live and capitalise on all the opportunities associated with normal classroom practice. Literature points to InSTEP-type activities having the potential to enhance the development of trainees' observation skills, develop reflective thinking, to provide authentic illustrations of classroom practice, enable remote observation and facilitate the coaching of trainees by mentors. A fourth generation model of evaluation was undertaken with data generated by semi-structured interviews with university tutors and mentors supported by a questionnaire and group interviews with the trainees.

The findings in the study showed that InSTEP enhances and accelerates the growth of trainee teachers' professional knowledge through enabling reflective practice, facilitating collaborative learning and supporting the development of the language of pedagogy.

Lambert and Gong (2010) conducted a study on 21st century paradigms for pre-service teacher technology preparation. This study investigated major course changes in 11 sections of a stand alone educational technology course redesigned around 21st century skill sets as opposed to technical skill development. Conducted in the fall of 2007 and spring 2008 with a random sample of 100 pre-service teachers, independent and paired sample 't' tests and correlational
analyses were used to examine differences in students' computer attitude, self-efficacy, and computer skills before and after instruction.

The findings in the study showed that, even in a more rigorous course, pre-service teachers became less anxious about computers, their belief in the value of using technology to enhance teaching and learning as well as their self-efficacy toward integrating technology in the classroom significantly improved, and they became more advanced in their technical skills and knowledge of how to apply these skills in the classroom.

*Turvey (2010)* conducted a study on pedagogical research designs to capture the symbiotic nature of professional knowledge and learning about e-learning in initial teacher education in the UK. The objective of the study was to study the effectiveness of a pedagogical research design based upon the authentic and situated use of e-learning strategies and technologies for developing student teachers' professional knowledge and understanding of online pedagogy. A case study is presented of an intervention, which attempted to synthesise a face-to-face and online school-based experience with university-based lectures, in order to develop student teachers' capacity to theorise and reflect upon the development of their online pedagogical practice. Theory that focuses on the complex and symbiotic nature of professional knowledge and learning was developed to analyse data in the form of interviews with student teachers and archived extracts from their online interactions with the children.

The findings in the study showed that, from the perspective of a dynamic conceptualisation of e-learning as continuously emerging and a pedagogical
research design that develops and captures student teachers' capacity to reflect upon the development of their own online pedagogy and professional knowledge and understanding in relation to e-learning is vital.

Jeong and Kim (2009) conducted a study on learning about problem based learning: student teachers integrating technology, pedagogy and content. This study examined the complexity of pre-service teachers' "Technological Pedagogical Content Knowledge" (TPCK) in the context of integrating Problem Based Learning (PBL) and Information and Communication Technology (ICT). Ninety-seven pre-service teachers in this study engaged in a collaborative lesson design project where they applied pedagogical knowledge about PBL to design a technology integrated lesson in their subject area of teaching. Data were collected from two sources: survey and lesson design artifacts.

The findings in the study showed that, while participants had theoretical understandings of pedagogical knowledge about PBL, their lesson designs showed a mismatch among technology tools, content representations, and pedagogical strategies, indicating conflicts in translating pedagogical content knowledge into designing pedagogically sound, technology integrated lessons. The areas that students perceived to be particularly challenging and difficult include: a) generating authentic and ill-structured problems for a chosen content topic, b) finding and integrating information and communication technology tools and resources relevant for the target students and learning activities, and c) designing tasks with a balance between teacher guidance and student independence. The present study suggests the potential of two explanations for
such difficulties: lack of intimate connection among beliefs, knowledge, and actions, and insufficient repertoires for teaching with technology for problem based learning.

Mamadou (2009) conducted a study on use of information and communication technology in teaching and teachers in private elementary schools in Mali. This study examines how well do teachers integrate information and communication technology into their teaching and what can be said about ongoing professional training for integrating information and communication technology into teaching. Twenty-seven of the 47 teachers in the two schools were surveyed.

The findings in the study showed that students and teachers in both schools do use information and communication technology but that no teacher training programmes exist for the moment to provide techno-pedagogical skills linked to the school curriculum or to the subject being taught. Rather, teachers are trained to use computers and certain applications without linking their use to teaching.

Cher and Ching (2008) conducted a study on teachers’ pedagogical beliefs and their planning and conducts of computer-mediated classroom lessons. The main objective of the study was to examine how teachers’ pedagogical beliefs affect the planning and conduct of the computer-mediated lessons. The ‘cases’ for the study were the six teachers from two primary schools in Singapore. Each teacher’s planning and conduct of the observed computer-mediated lesson in their respective school constitutes a case in this study. In this study, the researchers observed 18 lessons and their assessment was that the lessons were
predominantly traditional teacher-centric in nature. Although 14 of the lessons have some elements of constructivist teaching, the underlying orientation of the lessons were still geared towards information acquisition for the purpose of examination.

The findings in the study showed that except for one teacher who was holding traditional conception of teaching and a compatible perception of the affordances of computer, the other five teachers were practising computer mediated lessons. This case study therefore highlights the need of computer mediated classroom lessons.

Hong and Lin (2008) conducted a study on competency disparity between pre-service teacher education and in-service teaching requirements in Taiwan. The purpose of this study was to explore whether pre-service teacher education in Taiwan equips in-service teachers with the necessary knowledge and competency to meet the demands of the professional career. A questionnaire was developed to investigate such competency disparity. The questionnaire containing 44 items within six categories was distributed to 305 samples in Taiwan.

The findings in the study showed that risk management and proactive thinking skills are the most significant factors in terms of competency disparity. Moreover, the results of this study showed that years of service, and size of school have a significant difference in the value system of competency disparity. The results of this study can be applied to change the programme of prospective teacher education to enhance future teachers’ performance.
Kyriacos and Ifigenia (2008) conducted a study on the attitudes and opinions of Cypriot primary teachers about the use of the internet for their professional development and as an educational tool. The objectives of the study were to explore the attitudes and opinions of Cypriot primary teachers about the use of the internet for their personal development and as an educational tool and the teachers’ concerns about the implementation of the internet in schools and their opinions about what has to be done in order to ensure its effective integration into the educational settings. The methodology employed for collecting the research data was predominantly quantitative, with some qualitative elements. The quantitative strategy used was the survey and the research method employed was the self-completed questionnaire. The target population of the research included all Cypriot primary teachers who were working during the school year 2002–2003 and the sample was 240 teachers at random. Six questionnaires were sent to the head teacher of each school of the sample, who was asked to administer them to those members of the staff who might have some knowledge of what the internet is.

The findings in the study showed that Cypriot primary teachers had positive attitudes towards using the internet both for their professional development and as an educational tool. The only factor that appeared to have a significant positive relationship with the attitudes of the teachers was the degree of confidence in using the internet. Additionally, teachers considered training in the use of the internet as the most important need for its effective implementation in primary schools.
**Mary and Lynn (2008)** conducted a study on teachers and teacher educators learning from new literacies and new technologies. The study was undertaken as an instance of teacher research carried out in the context of a teacher education course in new literacies and technologies wherein teacher educators attempted to take up new literacies practices. Study participants were pre-service and in-service teachers.

The findings in the study showed that teacher educators must foster environments to share problem-solving and distributed learning, to support design and multimodal redesign of texts, and to explore literacy and technology as transactional processes. Whereas both teachers and teacher educators may be tempted to wait until they are technologically adapt before attempting to integrate new literacies and new technologies into their teaching, this study suggests that the learning environment, approach to learning, knowledge about multimodal text design, and stance toward literacy and technology may be far more important than the technologies that teachers use to enact their instructional plans.

**Renato, Wendy, Cal, Barry and Erica (2008)** conducted a study on teachers’ journeys towards critical use of information and communication technology. The purpose of the study was to explore teachers’ confidence and competence in using information and communication technology, as they participated in an information and communication technology development. Project conducted by an Australian education system in 12 primary schools. The research was designed to explore three questions: (i) How does the implementation process impact on teachers’ confidence and competence with information and communication
technology over the period of the project, and what factors influence teachers’ confidence and competence? (ii) How does teachers’ use of information and communication technology in the classroom change over the period of the project? (iii) What is the impact of different kinds of professional development on teachers’ confidence and competence and appropriate use of information and communication technology? The education system collected documentary data as part of the project implementation process and these were the primary data sources for the study. The five data sources were: (i) Background information about each school; (ii) Mapping of the culture in the school for curriculum improvement; (iii) Records of professional development undertaken by individual teachers; (iv) Information and communication technology learning co-ordinator reports describing progress in each school each term and an indication of each information and communication technology learning co-ordinator’s learning; and (v) Descriptions of small action learning projects undertaken by each teacher each term in their classrooms.

The findings in the study showed that most teachers shifted from little or no knowledge of information and communication technology to an initial focus on mastering the use of information and communication technology resources. Some teachers then progressed to focus on integrating information and communication technology in the curriculum. Given appropriate support, a majority of teachers were able to develop confidence and adjust to the new classroom dynamics. Over the project period teachers gradually began to select information and communication technology lesson directions and incorporate
new hardware and software. The rate and extent of this developmental process, however, varied from teacher to teacher and from school to school.

Zembat (2008) conducted a study on pre-service teachers’ use of different types of Mathematical reasoning in paper-and-pencil versus technology-supported environments. The current study compared the effects of technological environments with that of the paper and pencil environment on reasoning about the concept of derivatives in the context of maximum and minimum problems. The data consisted of clinical interviews conducted with three pre-service secondary mathematics teachers and a newly registered graduate student all of whom had quite a lot of mathematics courses in their repertoire.

The findings in the study showed that participants mostly depended on and were limited to analytical reasoning within paper and pencil environments, whereas they were able to refer to practical and creative reasoning with the help of the facilities technology environments provided. On the other hand, although participants made progress and used different reasoning types within technology environments, there were cases where they could not move beyond analytical reasoning even within the presence of technological tools.

Mikko and Antti (2007) conducted a study on prospective history teachers' information behaviour in lesson planning. The study examines young teacher trainees' information behaviour in lesson planning. Fourteen prospective history teachers were interviewed individually. Content analysis was conducted on transcribed interviews and qualitative data analysis software was used to segment, compare and organise the data. At the end of the training period the
teacher trainees were relatively fluent and versatile information seekers who were able to cope with the challenges of lesson planning and support textbooks with information retrieved from various information sources. The study gave an overall picture of teacher trainees' information behaviour in lesson planning.

The findings in the study showed that the trainees had the necessary skills to seek and use information for lesson plans. The results opened promising paths to pursue research on the trainees' information behaviour further, to address their potential as information literacy instructors. Most of the trainees were fluent users of web resources and can be called insiders in this respect. The teacher trainees accessed information through a diverse set of channels and utilised various types of sources. They applied various information seeking strategies based on their subject knowledge and the purposes for which they intended to use information. The trainees learned ways of coping with information overload. They were able to locate and retrieve relevant information.

Mutton and McNicholla (2007) conducted a study on mentor skills in a new context: working with trainee teachers to develop the use of information and communications technology in their subject teaching. The purpose of the study was to find out the role of the school-based mentor in developing the competence of trainee teachers in relation to the use of information and communication technology in the classroom. Data for the study were collected through questionnaires and interviews.

The findings in the study showed that many mentors feel that their information and communication technology expertise is often not as great as that
of the trainee and therefore feel less confident and or willing to offer guidance in this area and that they are unable to offer support to trainees in relation to contexts that involve the use of information and communication technology in the classroom.

Pasternak (2007) conducted a study on analysis of pre-service English teachers’ perceptions and classroom practices. The objectives of the study were if technology is used as practice in the English language arts classroom, and if these practices transferred from the methods classroom to the field experience and beyond. Survey method was adopted for the study.

The findings in the study showed that teacher candidates were integrating technology into ELA practice and, in many cases, exploring new literacies created through new media. They valued certain methods over others, but these seemed to be the technologies and methods that are readily available at schools, easily incorporated into practice, enhance content, or are valued and practiced by their cooperating teachers. Teacher candidates’ perceptions of integrating technology into their practices revealed their comfort or frustration with non-traditional teaching practices and classroom structures.

Thierry (2007) conducted a study on connecting student teachers during their internship: the role of information and communication technology. The objective of the study was to enhance understanding of the potential advantages of information and communication technologies in practical teacher training. More specifically, it aims to shed light upon how information and communication technologies help student teachers overcome teaching challenges encountered
during field practice. Survey method was adopted for the study. A total of 800 pre-service teachers (682 females and 118 males) enrolled in a four-year teacher education programme were selected to participate. Subjects had a mean age of 22 years old.

The findings in the study showed that Information and Communication Technologies help student teachers in various ways to face pedagogical and other challenges encountered during their practicum. Information and Communication Technology allow student teachers to profit from a vast network which can help them maximise their academic performance and even increase their wellbeing in sometimes difficult situations such as can occur in schools.

Irfan (2005) conducted a study on information and communication technology awareness, use and need of secondary and higher secondary teachers of English medium schools of Vadodara city. The objectives of the study were to study the information and communication technology awareness of secondary and higher secondary teachers, to study the information and communication technology use of secondary and higher secondary teachers, to study the information and communication technology need of secondary and higher secondary teachers, and to study the variables related with the information and communication technology awareness, use and need of secondary and higher secondary teachers. A scale was constructed to collect the data regarding information and communication technology awareness, use and need of a teacher with respect to different components of information and communication technology, such as, computer, internet, OHP, LCD Projector, radio and TV. 12 secondary and 10 higher
secondary schools were selected using stratified random sampling technique. Further 60 secondary and 50 higher secondary teachers were selected and 5 teachers from each selected school. A total of 90 teachers out of 110 responded.

The findings in the study showed that there was found a low degree of information and communication technology awareness, use and need of secondary and higher secondary teachers. The variables related to information and communication technology awareness of teachers were teaching experience, age and total salary. The variables related with the information and communication technology use of teachers were total salary and computer training. The variable related with the information and communication technology need of teachers was the degree programme which they attended at the University level.

Claxton (2003) conducted a study on faculty learning to use technology in their teaching: case studies of two institutions in higher education. The purpose of this study was to examine how faculty in institutions of higher education learns to use technology in their teaching. The study asked faculty to reflect on their experiences in order to gain a better understanding of methods used and support received for their use of technology. In order to do this qualitative methods were employed, specifically a dual case study. Interviews, a learning preference indicator and document analysis were used as data sources, and analysis of narratives was conducted. This study was conducted using three central questions concerning how and where faculty learned to use technology, how faculty were supported by the socialisation process as they implemented technology in their
teaching, and how opportunities for acquiring technology skills matched their learning preferences. Participants in both cases used similar methods; workshops, seminars, and one-on-one experiences, to learn new technologies for the classroom.

The findings in the study showed that many of these methods used sufficient variety in preservation modalities to meet their varied learning preferences. A key finding was the effect of perceived support by institutional leadership at, the highest levels on the socialisation process as faculty tried to learn technology and implement it in their teaching.

Ellis (2003) conducted a study on factors influencing teachers' use of computer-based technology. The purpose of this study was to determine if access to computer-based technology, participation in computer-based training, and amount of time teachers spend planning and using computer-based technology influence teachers' use of computer-based technology. One hundred forty-two elementary teachers from one North Central Texas county were surveyed concerning their access and use of computer-based technology. Both qualitative and quantitative data were gathered for this study. The chi-square statistic was used for each hypothesis. Cramer's $V$ measure of association was used, where appropriate, to identify the strength of the relationship between various variables. Emerging themes were identified from teacher interviews.

The findings in the study showed that many teachers report, not having the confidence and skills to effectively integrate computer-based technology.
Diane (2002) conducted a study on electronic lifeline: Information and communication technologies in a teacher education internship. The objective of the study was to find out the possibilities of utilising information and communication technologies in the practicum component of pre-service teacher education. It investigated the use of electronic discussion groups by pre-service teachers and university lecturers while the pre-service teachers were completing an internship towards the end of their teacher preparation programme. The participants in the study were secondary pre-service teachers completing a final 10-week internships experience of their teacher preparation programme.

The findings point to the value and benefits associated with using information and communication technology in the field based components of pre-service teacher education. However, the study also highlights a number of challenges and issues that must be addressed if this electronic learning environment is to provide an enabling learning space for becoming a teacher. Traditional roles in the practicum whereby the university person ‘supervises’ and the pre-service teacher is ‘supervised’ in the school, are blurred in this electronically mediated learning space. University teacher educators and pre-service teachers move in and out of these roles.

Duphorhe and Orth (2000) conducted a study on the effect of three computer conferencing designs on critical thinking skills of nursing students at a distance. This study addresses the need for educators to design experiences that enhance students' critical thinking ability within mediated-learning environments. An experimental study was designed to test the effect of advance organisers and
computer conference designs on critical thinking skills. The convenience sample (N=96) consisted of pre-licensed Bachelor of Nursing university students in Australia and R.N-BSN completion university students in the United States who were randomly assigned to one of three conference designs. A total of 18 conferences were run between September 1997 and May 1999. Critical thinking ability was measured using the California Critical Thinking Skills Tests (CCTST) and the California Critical Thinking Disposition Inventory (CCTDI). This study was designed to (i) demonstrate that students could learn while immersed within the VLE, and (ii) determine the impacts of varied collaborative experiences on learning. To study the effect of collaboration on learning, subjects were divided into three groups: (i) Group 1 individuals who received a minimal amount of support during learning exercise; (ii) Group 2 paired peers who collaborated throughout a learning exercise; and (iii) Group 3 guided individuals who completed a learning exercise in collaboration with an in-world expert companion. The study was conducted onsite at a public school in conjunction with regular classroom activities where completed data sets were recorded for 56 ninth grade students.

The findings in the study showed that between-group data analysis indicated that the Group 3 guided individuals were most likely to have undergone conceptual change followed by Group 2 peer pairs and Group 1 individuals, respectively. The implications of the findings include the following propositions: (i) Collaborative VLE experiences can be successfully integrated into existing school curricula; (ii) Structured collaborative experiences lead to a
more focused learning experience; and (iii) Collaborative VLEs provide the best overall benefit when used in conjunction with other instructional strategies.

Luke (2000) conducted a study on the pedagogy and practice of the teachers receiving pre-service preparation to use computing technologies. The purpose of this study was to investigate the current instructional practices and pedagogy of teachers who were given purposefully designed technology preparation in programme. The research questions focused on the pedagogy and practice of teachers in their fourth year of teaching who were intentionally trained to use technology in their pre-service teacher education programme. A case study approach was used and four elementary teachers who participated in the technology enriched pre-service programme were invited to participate in the study. Qualitative techniques were employed to select participants, collect and analyse data, and represent salient themes that emerged from the data as a result of attention to issues of trustworthiness and rigor. Data were collected using in-depth interviews, observations and document analysis and analysed using a constant comparative method. Many factors impacted on these four teachers' use of technology; some were external or within the school and district context and others were internal or specific to the teachers' beliefs and experiences. External factors played an important role in the practice and to some extent, the pedagogy of the four teacher participants. The two most salient themes that emerged related to external factors were the importance of an adequate technology infrastructure and the need for strong school leadership. The ethic of concern the teachers had
for their students deeply informed their teaching and their use of technology in their practice.

The emergent themes as related to the research questions reflect the finding that teaching with technology is fundamentally and foremost about teaching.

Montgomery (2000) conducted a study on teaching with technology: a qualitative study exploring experiences of teachers. The study addresses the absence of the teacher's perspective in the nature on teaching with technology. It describes the experiences of a group of teachers working to integrate computer related technology into the curriculum. The purpose of the study is to gain an understanding of the teachers negotiate the discontinuities inherent in working to its technology in the classroom. The study examines the attitudes, knowledge, skills, dispositions, barriers and events, which shape and give meaning to their teaching experiences.

Teachers have historically been overlooked as knowledge producers: perspectives have been deemed irrelevant. Within a qualitative/interpretive framework, this study privileges teachers' perspective. It assumes that teachers with experience teaching with technology have much to offer to an understanding of teaching computer related technology.

Sindylek (2000) conducted a study on computer usage in the United States and an evaluation of the current level of computer usage by public high school core content subject area teachers within the region IV education service centre schools located in Galveston Country, Texas. The purpose of this study was
trifold. First, an investigation to determine how the computer has met the needs of people and or society in the past was explored historically. Secondly, information was presented regarding the use of the modern-day computer in educational classrooms to determine the impact computer technology has on education. Thirdly, a survey was conducted to determine the reported level of access that core content subject area teachers in the study have to computers. The survey was designed to determine the reported amount of computer usage, the reported level of expertise, and the professional development needs related to technology. The subjects of this study were the 1081 faculty members employed in the identified school districts during the 1999-2000 school year. A total of 578 respondents completed the survey with 378 of the respondents identifying themselves as core content subject area teachers.

The findings in the study showed that the computer has been used to meet the needs of people and society throughout history. The U.S. Census Office benefited from the use of computer technology. The information presented regarding the use of computers in the classroom indicate that students can benefit from instruction enhanced with computer technology. The results of the survey indicate a lack of computer access by the respondents, a lack of computer use for instruction by respondents, adequate level of computer skills by respondents, and multiple areas related to technology in need of attention by the respondent's school district.

Spearman (2000) conducted a study on elementary educators' use of the internet and the application of information literacy skills to student use of the World Wide
The purpose of this study was to examine how nine elementary school teachers, grades fourth and fifth, reported using the World Wide Web with their students and more specifically, how they incorporated information literacy. The following research questions were investigated: (i) What is the teacher's understanding of the importance of the Web? (ii) What assignments or equivalents do they place on students that demonstrate the students' knowledge of information literacy and the Web? (iii) What information literacy instruction do they give students concerning the Web? (iv) How do teachers view students' abilities to use that knowledge in assessing what they find on the Web? (v) What is the teacher's understanding of information literacy? The qualitative research method used was a phenomenological study based on interviews structured around open-ended questions with spontaneous, related questions used to probe and elicit explanation and clarification. The transcriptions were filtered and analysed using the software package NUD-IST. Findings of this study revealed that while participants viewed the Web and Web activities positively they did not feel their students were developmentally ready for information literacy instruction.

The findings in the study showed that: (i) Teachers view the Web as an important resource for students and themselves and incorporate its use in assignments and activities. (ii) The participants in this study were unable or unwilling to provide opportunities for students to demonstrate knowledge of information literacy during web activities (iii) The participants' understanding of
information literacy was absent at the conceptual level and not, demonstrated in any student related activities.

**Peterson, Fennema, Crpenter and Loef (1989)** conducted a study on teachers' pedagogical content beliefs in Mathematics. The purpose of the study was to examine the relationships among first-grade teachers' pedagogical content beliefs, teachers' pedagogical content knowledge, and students' achievement in mathematics. Teachers (N=39) completed structured questionnaires and interviews on their beliefs and knowledge about instruction, children's learning, and the mathematics content in addition and subtraction.

The findings in the study showed that significant positive relationships among teachers' beliefs, teachers' knowledge, and students' problem solving achievement. Compared to teachers with a less cognitively based perspective, teachers with a more cognitively based perspective made extensive use of word problems in introducing and teaching addition and subtraction. They also spent time developing children's counting strategies before teaching number facts. Cognitively based teachers had greater knowledge of word problem types and greater knowledge of their children's problem solving strategies than did less cognitively based teachers. Furthermore, cognitively based teachers obtained this latter knowledge by observing their children in problem situations rather than by relying on tests or formal assessments. Children with cognitively based teachers scored higher on word problem solving achievement than did children with less cognitively based teachers, but children from both types of classes did equally well on addition/subtraction number facts.
Sibichen and Annaraja (2010) conducted a study on teacher trainees’ computer competency enhances their technology use in classroom teaching. The aim of the study was to find out whether teacher trainees’ computer competency enhances their technology use in classroom teaching. The survey method was used for the study. The investigator used stratified random sampling technique for selecting the sample. The sample of the study is secondary teacher education students studying in the B.Ed. colleges affiliated to Mahatma Gandhi University, Kottayam. The sample consists of 75 secondary teacher education students. The tool used was Techno-Pedagogical Skill Assessment Scale developed by Sibichen and Annaraja (2009).

The findings in the study showed that teacher trainees’ computer competency enhances their technology use in classroom teaching.

Darshana (2005) conducted a study on techno-pedagogic analysis of children ETV programmes and their effectiveness in terms of achievement with and without discussion and perception of students and teachers. The objectives of the study were to analyse the CETV programmes techno-pedagogically, to study the effectiveness of the CETV programmes in terms of achievement of students, to compare the achievement of students in CETV with and without discussion, to study the effectiveness of CETV programmes in terms of reaction of teachers, and to study the views of the students on the CETV programmes. Pre-test treatment- post-test, experimental and control group design was employed for the study. 60 student of Standard V of Shree Krishna Hindi medium school
constituted the sample for the study. Also all the 5 teachers teaching Standard V were selected. 5 programmes were selected purposively out of the 15 recorded. Techno-pedagogic analysis tool, achievement test on each selected CETV Programme, reaction scale, and un-structured interview were employed. Content analysis, presentation analysis, 't' test and percentage analysis were used for the study.

The findings in the study showed that the programmes were largely found effective techno-pedagogically in terms of mediagenicity, audio-visual compatibility, contiguity between text and animation and between audio and visuals, media language proficiency, use of technological aids, correspondence among communication elements, and view composition. All the six programmes were at knowledge level, 5 at understanding level, whereas 4 were at application level. Most of the programmes focused on receiving and responding. Three focused on valuing also. One of the 6 programmes focused on imitation, manipulation and articulation level. There was significant difference between the mean gain scores of control and experimental group in all the 6 programmes. In 5 out of six programmes, the mean achievement of the group with discussion was found significantly higher than that of without discussion. Children and teachers were found to have positive views regarding the programmes.

Mishra and Koehler (2005) conducted a study on introducing technological pedagogical content knowledge. The objectives of the study were to find out the evolution of student and faculty-participants’ learning and perceptions about the learning environment, theoretical and practical knowledge of technology, course
content, group dynamics, and the growth of techno-pedagogical content knowledge. The data collected from a faculty development design seminar in which faculty members worked together with master’s students to develop online courses. Survey method was adopted for the present study.

The findings in the study showed that participants perceived that working in design teams to solve authentic problems of practice to be useful, challenging and fun. More importantly, the participants, both as individuals and as a group, appeared to have developed significantly in their knowledge of technology application, as well as in their TPCK. In brief, learning by design appears to be an effective instructional technique to develop deeper understandings of the complex web of relationships between content, pedagogy and technology and the contexts in which they function.

Rathod (2002) conducted a study on perception of B.Ed. students towards information and communication technologies in education- a compulsory course proposed to be offered in B.Ed. at the M.S. University of Baroda. The sample for the study was constituted of all the B.Ed. students (2001-2002) of the MSU. A questionnaire was constructed by the investigator for the purpose.

The findings in the study showed that 12% of the students were found to have their own computers. 53% of the students were found to have Internet awareness. 95% of the students responded that information and communication technology in education is needed at B.Ed. level as a compulsory course. All the sample students have responded that information and communication technology literacy camps should be organised for the teacher educators. Further they think
that every method master should have adequate competencies with respect to the integration of Information and Communication Technology. A majority (88%) of the students think that Information and Communication Technology in education as a compulsory course should have an umbrella approach wherein each pupil teacher should have workable knowledge of different languages, software packages and network technologies.

(2) STUDIES ON THINKING SKILLS

(i) Studies Abroad

Demetra and Constantinos (2011) conducted a study on the structure of prospective kindergarten teachers’ proportional reasoning. The aim of the study was to test a theoretical model based on the teaching fractions and ratios for understanding as well as an extended model which included an additional component of solving missing value proportional problems. Data were collected from 238 prospective kindergarten teachers. To a great extent, the data provided support for the extended model.

The findings in the study showed that prospective kindergarten teachers possess in regard to proportional reasoning and the types of processes that might be emphasised during their education.

Gillies and Robyn (2011) conducted a study on promoting thinking, problem solving and reasoning during small group discussions. The aims of the study were to find out the types of questioning strategies teachers use to promote thinking, problem-solving and reasoning during small group discussions and the types of discourses students use to solve problem and reason during their small group
discussions. An audiotape of one class lesson from the three teachers included in the study and a sample of a small group discussion from each classroom were collected and fully transcribed.

The findings in the study showed that the teachers used a variety of questioning strategies, ranging from those that challenged children's perspectives to those higher-level questions that required children to provide reasons, make connections and think metacognitively. In turn, the children appropriated many of these ways of thinking and talking and used them in their interactions with each other. The study shows that if teachers want to encourage children to engage in higher-level thinking and talking then they need to explicitly guide and scaffold these discourse patterns in their interactions with their students.

Paul (2011) conducted a study on the attitudes towards critical thinking among Hong Kong secondary school teachers: Implications for policy change. The aim of the study was to find out the attitudes towards critical thinking among Hong Kong secondary school teachers. In this study, 72 high school teachers in Hong Kong were surveyed and interviewed on their beliefs about the meaning of critical thinking.

The findings in the study showed that, while the teachers had some conception of the term, it tended to be narrow. Further, they expressed strong support for the inclusion of critical thinking in the curriculum, while conveying a desire for training in how to teach it.

Zsuzsanna and Jonathan (2011) conducted a study on learning methods for teacher education: The use of online discussions to improve critical thinking.
This study investigates the use of online discussion forums to improve undergraduate pre-service teachers' critical thinking skills. Participants in the study were 93 students registered in four sections of an Educational Psychology course at a Midwestern university. To control for learning preferences, all participants in the study took the Canfield Learning Style Inventory as a pre-test. Students also completed the Ennis-Weir Test of Critical Thinking as pre and post-test. In two of the four sections students used the Blackboard virtual learning environment to complete weekly discussions on course topics as part of their regular coursework.

The findings in the study showed that critical thinking measure showed an increase in students' critical thinking skills over the course of the semester. The analysis of online postings demonstrates an increase in higher order thinking skills as measured with a rubric based on Bloom's taxonomy. Results revealed that the use of online discussion forums as an instructional tool in a face-to-face course improved undergraduate pre-service teachers' critical thinking skills.

Fahmi and Hmoud (2010) conducted a study on Jordanian TEFL graduate students’ use of critical thinking skills. This study investigates the critical thinking skills of 50 students currently enrolled in the Master’s TEFL Programme at Yarmouk University, Jordan. The Cornell Critical Thinking Test, Level Z is utilised to test the students’ use, or lack there of, of the critical thinking skills of deduction, semantics, credibility, induction, definition and assumption identification, and assumption identification. The effect of the variables of
gender, age and grade point average on the students’ critical thinking abilities is also investigated.

The findings in the study showed that the respondents performed quite poorly on the test. Gender, age and grade point average were all found to have an effect. Male students outperformed female students. However, while older male students outperformed younger ones, younger female students outperformed their older counterparts. Respondents with higher grade point averages scored better on the test. The findings have implications for TEFL education in Jordan and other similar contexts. As teachers can be highly influential in creating a classroom environment that promotes critical thinking, they need to be informed about the importance of developing their students’ critical thinking skills. To make this possible, EFL teachers should be allowed pre-service and in-service training opportunities to encourage the development of critical thinking.

Choy and Cheah (2009) conducted a study on teacher perceptions of critical thinking among students and its influence on higher education. This study focuses on teachers’ perception of critical thinking among their students and how this could influence the manner in which they teach and whether they are able to encourage this form of thinking among their students. The main research questions underpinning this study were (i) What are teacher’s perceptions of critical thinking? (ii) What are their perceptions of students’ ability to think critically? (iii) What are their perceptions of the role they have to play when incorporating critical thinking in their lessons? The investigation was carried out using a qualitative approach. The sample taken for this study is made up of
teachers teaching in institutions of higher learning in Malaysia who volunteered to take part in the study during three teacher development workshops conducted. These teachers come from various disciplines. A questionnaire was used to generate data for this investigation. The 30 respondents were asked to answer a questionnaire with a total of 8 questions. The questions were focused on drawing out their perceptions on critical thinking. Analysis of the salient points of the data resulted in total of 6 categories of teachers’ perception of critical thinking.

The findings in the study showed that the respondents had two ways of perceiving critical thinking. A majority of them perceived that critical thinking was a method of thinking that would help students enjoy the learning process. This implies that critical thinking can be a tool to stimulate students’ thinking and help them obtain better learning outcomes. The other respondents thought of critical thinking as involving reasoning which helped students analyse their learning. Most of the respondents perceived that students demonstrated critical thinking when they were able to perceive facts thoughts and ideas from a new perspective and defend these ideas with sound argument. Based on this research, the results of the analysis do not seem to show that these students had been able to acquire all the skills necessary for critical thinking, although their teachers perceive they are demonstrating this type of thinking. The results show that teachers perceive they are teaching critical thinking to their students. They believe that critical thinking will provide the intellectual stimuli that will facilitate learning among students. They perceive that students’ ability to explain concepts in their own words is evidence that they were thinking critically.
Jansen and Spitzer (2009) conducted a study on prospective middle school Mathematics teachers' reflective thinking skills: descriptions of their students' thinking and interpretations of their teaching. The study examined prospective middle school mathematics teachers' reflective thinking skills to understand how they learned from their own teaching practice when engaging in a modified lesson study experience. The purpose was to identify variations among prospective teachers' descriptions of students' thinking and frequency of their interpretations about how teaching affected their students' learning. Thirty-three participants responded to open-ended questionnaires or interviews that elicited reflections on their own teaching practice. Prospective teachers used two forms of nuance when describing their students' thinking: (i) identifying students' specific mathematical understandings rather than general claims and (ii) differentiating between individual students' thinking rather than characterising students as a collective group. Participants who described their students' thinking with nuance were more likely to interpret their teaching by posing multiple hypotheses with regard to how their instruction affected their students' learning. The "Direct-instruction Model" favours the use of teacher explanations and modelling combined with student practice and feedback to teach thinking skills. Using this paradigm, this study incorporates e-learning during an 18-week experimental instruction period that includes 48 pre-service teachers. The instructional design in this study emphasises scaffolding, observational learning, mastery of critical-thinking skills, guided practices, co-operative learning, providing feedback, self-reflection, online discussions, and active participation in an online learning community. This study employs critical-thinking tests, inventories, and open-ended reflection
questionnaire; and students' scores on the pre-test and post-test are compared via the Repeated Measure Analysis of Variance.

The findings in the study showed that: (a) all participants preferred the instructional design in this study; (b) the experimental instruction effectively improved the pre-service teachers' critical-thinking ability as well as their professional knowledge and personal teaching efficacy concerning critical-thinking instruction; (c) the mechanisms contributing to the effectiveness of the experimental instruction mainly included discussing and sharing, observational learning, self-reflection, guided practice, and the learning community.

Hirose (2009) conducted a study on family consumer sciences teacher’s use of technology to teach higher order thinking skills. This study determined if teachers had enough support and training to use technology. Lesson plans were accumulated that required both technology and higher order thinking skills. These lessons were then categorised by subject and level of higher order thinking skills. Family And Consumer Sciences (FACS) high school teachers were surveyed on their use of technology to teach Higher Order Thinking Skills (HOTS). Quantitative and qualitative data were gathered via Survey method.

The findings in the study showed that FACS teachers have enough support and training in the areas of finances, training, time, computers, and confidence in their abilities, as 80% of teachers were sufficiently supported and trained. These findings were compared with teachers’ use of technology to teach HOTS, according to the International Society for Technology in Education’s Standards. Ninety percent of teachers agreed or strongly agreed that they were
using technology to teach HOTS and were sufficiently supported and trained in
the use of technology.

Sendag and Odabasi (2009) conducted a study on effects of an online problem
based learning course on content knowledge acquisition and critical thinking
skills. This study investigated how the online Problem Based Learning (PBL)
approach employed in an online learning environment influenced undergraduate
students' critical thinking skills (CTS) and content knowledge acquisition. The
pre-test-post-test control group design was used in the study. The subjects
included the students who were enrolled at the Department of Primary School
Mathematics Teaching in Anadolu University Education Faculty. Subjects
attended to Computer II course in 2008 spring. Experiment group attended the
online PBL course whereas the control group attended the online instructor-led
course. Each group consisted of 20 students. Data collection tools consisted of a
multiple choice content knowledge acquisition scale and the Watson-Glaser
critical thinking skills test.

The findings in the study showed that learning in the online PBL group
did not have a significant effect on the content knowledge acquisition scores. It
was also revealed that learning in the online PBL group had a significant effect
on increasing the critical thinking skills.

Barak and Shakhman (2008) conducted a study on higher-order thinking in
science class: teachers' reflections. The study aimed at exploring what teachers
know and do about fostering higher-order thinking skills in teaching science, and
how they see themselves involved in achieving this end. Data were collected
through semi-structured interviews with 11 teachers experienced in teaching high school physics, which is considered a relatively difficult but well-established discipline.

The findings in the study showed that a diversity among the teachers in four areas: meta-strategic knowledge of the concept of higher-order thinking; practical utilisation of instructional strategies related to fostering higher-order thinking in the classroom; beliefs about students' abilities to acquire higher-order thinking skills; and self-perception regarding teaching towards higher-order thinking. Regarding the second area, for example, some of the teachers reported using teaching strategies in class that could impede the development of students as autonomous thinkers; others occasionally try to foster higher-order thinking among their students but regard this as a way of conveying subject content better; only a minority of the teachers see the fostering of higher-order thinking as an important objective of teaching physics. In summary, teachers are frequently puzzled or uncertain about the entire issue of fostering higher-order thinking in school.

Charles (2008) conducted a study on enhancing the thinking skills of pre-service teachers: A case study of Komenda teacher training college. This qualitative single case study answers two major questions. These are (i) What factors have affected the enhancement of thinking skills in pre-service teacher education institutions in Ghana? (ii) How can the thinking skills of pre-service teachers in initial teacher education institutions be improved? The study investigated the problem at Komenda Teacher Training College in Ghana. The field strategies used included interviews, observations, and documents. The purposive sampling
technique was used to select three teachers from science, mathematics, and social studies and thirty students. The researcher used inductive and creative synthesis to analyse the data and the narrative-logic approach as the presentation strategy.

The findings in the study showed that enhancing thinking skills of learners is a secondary concern in pre-service teacher training. It was found that teaching strategies employed by teacher trainers, classroom environment, administrative issues like students' recruitment, large class sizes, staff development, and examinations, nature of the school system school/culture of the society, and documents do not support the enhancement of the thinking skills of pre-service teachers. To ensure that pre-service teachers are trained in the art of thinking for themselves and extending this to their students, the study found that there should be a collaborative effort among all who are involved in the preparation of pre-service teachers.

Grosser and Lombard (2008) conducted a study on the relationship between culture and the development of critical thinking abilities of prospective teachers. The purposes of this study are to elucidate the critical thinking abilities of a mixed cultural group of 114 prospective first-year student teachers studying for a B.Ed. degree at a South African university by means of the Watson-Glaser Critical Thinking Appraisal and to provide insight into the relationship between the critical thinking abilities of the group of prospective teachers and their various cultures.

The findings in the study showed that a considerable number of the sample of prospective teachers are not yet functioning on Grade 12 level with
regard to the execution of critical thinking skills. The sample's apparent inability
to execute critical thinking skills is clear from this research and it seems as if the
various cultural worlds of these prospective teachers have not prepared them for
the execution of critical thinking abilities.

Kong (2008) conducted a study on critical thinking dispositions of pre-service
teachers in Singapore: A preliminary investigation. The purpose of this study
was to examine the effects of a thinking module on the critical thinking
dispositions of the pre-service teachers. Twenty-nine pre-service teachers have
participated in this preliminary investigation. A pre-test and post-test quasi-
experimental design was employed in this study. Dispositions towards critical
thinking were measured using the California Critical Thinking Dispositions
Inventory (CCTDI).

The findings in the study showed that participants in the experimental
group scored significantly higher in their CCTDI post-test. In summary, critical
thinking dispositions of the pre-service teachers who have been exposed to the
thinking module can be improved and thus such inclination towards critical
thinking can cause the teachers to be more critical in their approach whether
within their academic reasoning or everyday reasoning. This everyday reasoning
includes the ability to tackle classroom problems or issues not only in terms of
academic problem but also classroom management problems.

Ruth and Jean (2008) conducted a study on the use of the interactive whiteboard
for creative teaching and learning in literacy and Mathematics: a case study. The
aim of the study was to find out the ways in which the interactive whiteboard
may support and enhance pedagogic practice through whole-class teaching within literacy and numeracy. Case study method was used in this research. Data collected from observations of whole-class lessons, alongside individual interviews and focus group discussions with class teachers and initial teacher education students, has provided opportunities to consider the potential of such technology to facilitate a more creative approach to whole-class teaching.

The findings in the study showed that in the first instance, the special features of Information and Communications Technology such as interactivity, speed, capacity and range enhance the delivery and pace of the session. This research seems to indicate that it is the skill and the professional knowledge of the teacher who mediates the interaction, and facilitates the development of pupils' creative responses at the interface of technology, which is critical to the enhancement of the whole-class teaching and learning processes.

Seker and Komur (2008) conducted a study on the relationship between critical thinking skills and in-class questioning behaviours of English language teaching students. This study aimed at investigating the relationship between critical thinking skills and in-class questioning behaviours of English Language Teaching (ELT) students at the Faculty of Education at Mugla University. The study finds out answers to the following questions: (i) What kinds of questions do students in lower and higher critical thinking groups ask? and (ii) Is there a difference between the questions of students with higher and lower critical thinking scores? Three data collection instruments were used: Ennis-Weir Critical Thinking Essay Test; a reading passage; and a structured interview.
The findings in the study showed that the questions asked by the students of the higher critical thinking score group are not questions that clarify unclear points, but questions asked out of curiosity, to remove the uncertainties, and to lead people to think profoundly. Moreover, these students ask questions to find alternatives, to think the reverse and to head for new ideas. The students in the higher score group experienced thinking processes more intensively than the lower score group.

Sezer (2008) conducted a study on integration of critical thinking skills into elementary school teacher education courses in Mathematics. This study compares the effects of integrating critical thinking skills into a teacher preparation course in mathematics by examining a control and an experimental group.

The findings in the study showed that emphasis on critical thinking, even in one course content, can have positive effects on students' attitudes and achievement in mathematics.

Ya-Ting and Heng-An (2008) conducted a study on beyond critical thinking skills: Investigating the relationship between critical thinking skills and dispositions through different online instructional strategies. The purpose of this study was to investigate (i) the relationship between Critical Thinking Skills (CTS) and Critical Thinking Dispositions (CTD), and (ii) the effectiveness of different levels of instructional strategy (Asynchronous Online Discussions (AODs), CTS instruction via AODs, and CTS instruction with CTD cultivation via AODs) in improving students' CTS and CTD. A pre-test and post-test quasi
experimental design was employed to achieve this purpose. The participants in this study were 220 students enrolled in a general education course at a large university in Taiwan.

The findings in the study showed that: (i) the overall relationship between CTS and CTD was positive. However, further analysis of the relationship between the different levels of CTS and CTD showed that only the students with high CTS and medium CTD showed a significant correlation; (ii) the enhancement in CTS reinforced CTD, but the improvement in CTD did not increase the level of CTS. In addition, it is recommended that to improve the CTS and CTD of all students (including the students with a high level of CTS), the instructional strategy, CTS instruction with CTD cultivation, be employed.

Sam and Wah (2007) conducted a study on pre-service teachers' perceptions of an online mathematical problem solving course: A constructivist approach. This objective of the study was to investigate the effectiveness of teaching a mathematical problem solving course via the Web using a social constructivist approach. This study looked at participants' perceptions and satisfactions with the online learning environment. A total of 37 pre-service teacher trainees at the Batu Lintang Teacher Institute, Sarawak, Malaysia were the participants of this study. In this online course, the participants were required to complete the course online without face-to-face classes and they were also required to solve authentic mathematical problems in small group of 4-5 participants based on the Polya’s Problem Solving Model via online asynchronous discussion. The online asynchronous discussion enabled the participants to discuss and share knowledge
and solutions. Quantitative and qualitative methods such as questionnaires and interviews were used to evaluate the effects of the online learning.

The findings in the study showed that majority of the participants were satisfied with their learning experiences in the course. The participants also perceived that they need to have positive attitudes, self discipline, self independence, and self confidence to succeed in the course. Some of the difficulties faced by the participants in the course were technical problems, inadequate computer training for some of the required software and feeling of isolation. Thus, the online mathematical problem solving course using the social constructivist approach was appropriate and ought to be given serious attention as an alternative to traditional classes. Nonetheless, pedagogical considerations should be taken into account in designing and implementing online courses to minimise problems that participants might encounter while participating in such courses.

Li-fang (2006) conducted a study on student-teacher thinking style match/mismatch matter in students’ achievement. This study concerns the contingent nature of the relationships of student-teacher style match (or mismatch) to students’ academic achievement. Participants were 135 (59 male and 76 female) students (average age of 21.5 years) from three academic disciplines (mathematics, physics, and public administration) who responded to the Thinking Styles Inventory and rated their own abilities (analytical, creative, and practical). The academic achievement scores in two subject matters for each student were also used. The students’ subject matter teachers responded to the Thinking Styles in Teaching Inventory.
The findings in the study showed that the effects of style match/mismatch upon students’ achievement vary as a function of academic discipline and subject matter. The findings in the study also showed that the statistical procedures used to analyse the data play an important role in the relationships under investigation and students’ self-rated abilities make a difference in the tested relationships. Findings have implications for both researchers and teachers.

Oral (2006) conducted a study on creativity of Turkish prospective teachers. This study investigated whether 4 dimensions of creativity (fluency, flexibility, originality and elaboration) are accounted for at the university entrance examination to select prospective teachers in Turkey. The study sample consisted of 140 undergraduates at Akdeniz University, School of Education, Department of Elementary Teaching. All students in Grades 1, 2, 3, and 4 (51 male, 89 female) were included in the sample. Tool used was Torrance Tests of Creative Thinking (TTCT). Linear regression analyses were conducted to investigate whether the dimensions (fluency, flexibility, originality, and elaboration) in the TTCT predict university entrance examination scores. In the analyses, university entrance examination scores in verbal, numeric, and equal weight subtests were the dependent variables, the four dimensions of creativity (fluency, flexibility, originality, and elaboration) and age were the independent variables. Separate analyses were conducted for each of the dependent and independent variables.

The findings in the study showed that although creativity dimensions were not included in university entrance examination in previous years, they are taken into consideration at moderate but significant levels in recent years. This
shift at university entrance examination which is a standardised test, appears to be the sign of an educational innovation; however, it is not sufficient to produce an educational reform for a creative, developed society.

Greensfeld and Lehman (2004) conducted a study on how do we think? teachers in education colleges reflect on the thinking in their respective disciplines: science and literature. The purpose of the study was to investigate the ways in which the disciplines of science and literature influence concepts related to thinking among teachers at colleges of education. Tools were developed to distinguish between what teachers declared to be important in the thinking skills necessary for their discipline and the skills the teachers actually used. The questionnaire was filled in by 118 participants from 21 teachers' colleges throughout Israel. Of these participants, 64 (44 women and 20 men) teach courses in various areas of science (life sciences, physics, and chemistry), and 54 (45 women and nine men) teach various topics related to literature.

The findings in the study showed that no substantial difference has been found between the two groups of teachers, in terms of their distribution, in years of experience and level of academic degree. A quantitative and qualitative analysis was carried out of the findings. Thinking skills unique to each discipline and common thinking skills were found. The study revealed the discrepancy between the declared views of thinking skills held by teachers and their active use. Results of this study can help build an environment that develops a culture of thinking among both teachers and future teachers in educational colleges.
Mahyuddin, Pibie, Elias and Konting (2004) conducted a study on the incorporation of thinking skills in the school curriculum. The objectives of this study were to find out how far students are inculcated with: a) critical thinking b) creative thinking; and c) divergent/convergent thinking. This research utilised the survey method using questionnaire designed by the researchers. The study utilised the cluster sampling method where 387 upper secondary school students aged between 15 to 16 years became the respondents. This study utilised a self-designed inventory based on the model developed by the Ministry of Education Malaysia (MOE) on thinking skills (The Critical and Creative Thinking Skills, 1996). Each item was a construct according to the definitions of thinking skills by MOE. The scaling technique of 1–9 was utilised to measure the students’ perceptions of the incorporation of thinking skills by the teachers. Data were analysed by utilising the statistical mean, standard deviations and ANOVA.

The findings in the study showed that teachers incorporated critical thinking skills, creative thinking skills as well as convergent/divergent thinking skills in their teaching of their subjects. The result of this study also showed that the vocational/technical and science and mathematics students seemed to have better perceptions of the teachers incorporating the thinking skills as compared to those students who perceived their language teachers. Though this study showed that there is a new trend in teaching and learning where students are actively involved in the learning process, there is plenty of room for improvement in incorporating the thinking skills.
Ulker and Seher (2004) conducted a study on the decision-making skills of co-operating teachers and student teachers of English in a Turkish context. This study investigates in what aspects experienced teachers (co-operating teachers) and less experienced teachers (student teachers) differ when making instant decisions on diverting from their lesson plans as they teach, and what cultural/institutional influences can be related to these differences. The data for this qualitative study came from four co-operating teachers and seven student teachers through several research instruments: video-taping the participant teachers’ lessons, the interviews held at post-teaching meetings, the written retrospectives, and the questionnaire.

The findings in the study showed that while ‘timing’ and ‘classroom management’ were major motives for student teachers to make changes in their plans, co-operating teachers were more concerned about discipline problems. Both groups of teachers were equally affected by ‘motivation’, ‘physical conditions’ and ‘language skills’ in making instant decisions.

Griffin (2003) conducted a study on using critical incidents to promote and assess reflective thinking in pre-service teachers. The purpose of this study was to determine the effects of critical incidents and associated instructional activities on the reflective abilities of pre-service teachers. This study examined the effectiveness of using critical incidents in a supervised field experience with explicit instruction and coaching to increase the capacity of pre-service teachers to develop reflective and critical thinking skills. The study was conducted at a mid-size Midwestern university, 135 critical incidents were collected from 28
undergraduate pre-service teachers during a six-week, half-day field experience, the semester prior to student teaching. In a co-requisite course, instructional activities, including the critical incident tool, were used to promote critical reflection. Examination of frequency and category data showed that writing critical incidents increased the degree of pre-service teachers’ orientation toward growth and inquiry.

The findings in the study showed that the use of critical incidents and related instructional activities increased one reflective ability of pre-service teachers. Specifically, the data indicate an increase in the degree of orientation toward growth and inquiry, from concrete thinker to alert thinker. The critical incidents appeared to assist concrete thinkers to look beyond themselves and the immediate situation to larger, contextual issues. Analysis of the modes of reflective thinking indicated that the number of pre-service teachers using the contextual mode doubled in the cycle of writing, feedback, dialogue, experience, and writing. These results indicate that critical incidents may promote an increase in awareness of the variables that impact teaching and learning.

Jung and Leah (2003) conducted a study on What Hong Kong teachers and parents think about thinking. The purpose of the study was to investigate the views of Hong Kong teachers and parents of preschoolers regarding what constitutes thinking skills, and their views on the importance of thinking skills in the lives of children. A questionnaire was administered to forty teachers and forty parents of each group of K2 (age four to five years) and K3 (age five to six years) preschoolers to survey their perceptions on what thinking skills are and their
views on the importance of thinking skills in the lives of children. All subjects were asked to define thinking skills, to respond with any words or phrases that may serve as a ‘definition or explanation’ of thinking skills.

The findings in the study showed that teachers’ and parents’ overall definitions/ explanations about thinking skills appeared to converge on three main categories: namely, process of thinking, the most frequent response for teachers and parents; foundation of/for other learning; and academic: general-specific subject areas. It appears that teachers and parents were quite close in agreement in their overall definitions/explanations about thinking, with some frequency rank order differences. Teachers and parents differed slightly on their estimations of the percentage of class time being spent on thinking skills. The majority of the teachers felt that it was about fifty percent. The majority of the parents indicated that it was below fifty percent. The majority of teachers and parents felt that thinking skills should be taught but these responses did not suggest specifics. Concerning the role of parents in developing thinking skills, teachers felt that parents should be partners who should model/talk/act/enrich/should learn how to teach. Qualitative analysis of the responses indicated very clearly that teachers and parents believed that it was not necessary to teach thinking skills deliberately. While many of the teachers and parents in the Hong Kong sample affirmed that teachers should teach thinking skills, many of the responses of both groups indicated the view that it was not necessary to make deliberate plans to teach the skills and that these strategies were already incorporated into the curriculum. The parents felt that teachers should be
responsible for creating an “environment that promotes thinking naturally”, as one parent stated. They should play the role of guide and facilitator.

Lim, Cheng, Lam and Ngan (2003) conducted a study on developing reflective and thinking skills by means of semantic mapping strategies in kindergarten teacher education. The purpose of the study was to find out the affective outcomes resulting from the use of semantic mapping strategies as a tool for developing reflective and thinking strategies among kindergarten student-teachers. The sample included 58 student-teachers, representing about 67% of the 1997–1999 cohort. An additional 29 student-teachers, representing about 25% of the 1998–2000 cohort, were also included in the sample. These student-teachers completed the component of Language that was also part of the module “further studies in kindergarten curriculum”. Kindergarten teachers/principals were interviewed to discern how they developed critical thinking and evaluative skills concerning subject matter content and teaching curriculum through the use of semantic webbing.

The findings in the study showed that a change in perspectives and attitudes towards subject matter content and teaching curriculum. There were differences in: perceptions and understanding of basic concepts such as semantic mapping strategies and reflective practice; the purposes of these maps, and the purposes and strategies of modelling reflective practice; as well as the criteria for evaluating semantic maps. Fears, anxiety and frustration arise from a mismatch between the perceived problems of teacher-educators and those of student-teachers. Strategies applied to alleviating these worries and negative feelings
included clarification of the basic concepts, assessment criteria and teaching strategies to be adopted. Most important of all was a realisation that modelling reflective practice was essential if student-teachers were expected to experience reflective practice in action for themselves so that they could become reflective practitioners as well.

**Ron and David (2002)** conducted a study on dispositions toward critical thinking: the pre-service teacher’s perspective. This study examines the Critical Thinking (CT) dispositions of 202 pre-service physical education students in the US. All were juniors or seniors and enrolled in physical education secondary teaching methods classes. Survey method was adopted for the present study.

The findings in the study showed that a positive inclination toward critical thinking on six of seven subscales and the total score of the California Critical Thinking Dispositions Inventory (CCTDI). When compared with other university populations, the pre-service physical education samples generated higher scores than community college students, but were generally outsored by students from a private 4-year university cohort. Knowledge of the CCTDI data can be used to assist physical education teacher educators as they prepare teachers capable of fostering CT in their students.

**Edwards and Gary (2001)** conducted study on higher-order thinking versus lower-order thinking skills: does school-day scheduling pattern influence achievement at different levels of learning? The purpose of this study was to compare the higher and lower order thinking skills achievement of students enrolled for a secondary-level course in animal science on a Traditional school
day schedule to the achievement of students enrolled for the course on a block schedule basis (modified A/B (alternating day) and nine-week accelerated (4X4) semester block schedules). This was a descriptive study that employed the causal-comparative method to describe and explore possible cause and effect relationships between school-day schedules and the achievement of intact groups. The responding sample included 45 teachers representing 23 traditional scheduled schools with 341 students and 22 block scheduled schools with 325 students. Student achievement was measured by two examinations/scales based on an extension of Newcomb and Trefz' (1987) "levels of learning" model. The scales consisted of 33 HOTS and 23 LOTS items. Teachers answered a questionnaire describing themselves and their schools. Student achievement was slightly more than half of the "conventional" 70% passing standard.

The findings in the study showed that neither HOTS nor LOTS performance of students on a traditional schedule was significantly different than that of the block scheduled students. Multiple regression analyses with hierarchical order of entry were performed. The moderator variables student length of FFA membership and teacher tenure significantly explained student variability for both levels of achievement (longer FFA membership and longer teacher tenure resulted in greater achievement); the scheduling variable Traditional versus Block did not explain additional student variability in achievement. One could not conclude that one schedule was superior to the other in improving student achievement.
Denise (1999) conducted a study on reflective thinking among pre-service elementary Mathematics teachers. This study was undertaken in the context of a mathematics methods course for pre-service teachers. Two research questions guided this study: (i) How do pre-service teachers try to make sense of what they observe in a fourth-grade classroom during mathematics instruction? (ii) What aspects of the teaching-learning environment of the fourth-grade mathematics classroom do pre-service teachers find problematic? Data were collected in the form of individual interviews, group discussions, and individual journals.

The findings in the study showed that the pre-service teachers exhibited concerns about the classroom context, pedagogy of mathematics, children's mathematical thinking, and, to a lesser extent, the mathematics content. The data indicate a relationship between the pre-service teachers' locus of authority and the reflective quality of their thinking.

Reed and Kromrey (1998) conducted a study on effect of a model for critical thinking on student achievement in primary source document analysis and interpretation, argumentative reasoning, critical thinking dispositions and history content in a community college history course. This study investigated the effect of integrating Richard Paul’s model for critical thinking into a U.S. history course on community college students’ (i) abilities to think critically about U.S. history and about everyday issues, (ii) dispositions toward thinking critically, and (iii) knowledge of history content. This study also examined if age (under 22, 22 and older) or gender moderated the effectiveness of the instructional method. Four sections of U.S. History 1877 to the present participated in this one semester
study. Two sections were randomly selected to serve as the experimental group and the other two sections served as the control group. The experimental group (n = 29) received approximately 90 minutes of explicit instruction distributed over the semester in using Paul’s model for critical thinking to analyse and interpret primary source documents. In addition, the model was integrated into a series of assigned classroom activities. The control group (n = 23) was taught in a more traditional manner. Students took three pre-tests and four post-tests to measure the effectiveness of the instructional model: a Documents Based Question (DBQ) from an Advanced Placement Examination, the Ennis-Weir Critical Thinking Essay Test, the California Critical Thinking Dispositions Inventory (CCTDI), and a History Content Exam.

The findings in the study showed that there were no significant differences on the CCTDI or on the History Content Exam. No significant differences were found in the effectiveness of the method of instruction by age or gender. Three major findings emerged from this study: (i) community college students’ abilities to think historically and to think critically improved in a single course; (ii) community college students’ end of term knowledge of history content did not suffer when training in critical thinking abilities was integrated into course material; (iii) age and gender did not play significant roles in developing college students’ critical thinking abilities.

Melancon, Shaughnessy, Acheson, Gaedke and Moore (1997) conducted a study on critical thinking skills: levels of pre-service elementary, secondary, and special education students. The objective of the study was to assess the
development of critical thinking as pre-service teachers progress through their educational programme. Students will be assessed during their final year in the programme to help give an overview of the growth of their critical thinking skills. The Cornell Critical Thinking Test (Level Z) was administered to students in elementary (n=44), secondary (n=20), political science (n=24), psychology (n=19), and a combined group of early childhood, bilingual, and special education students (n=11). Those enrolled in the student teacher programme will be assessed again to evaluate their growth in thinking skills. The means and standard deviations for the groups are presented with means similar across the groups.

The findings in the study showed that few teachers, programmes, and institutions actively integrate, assess, teach, and evaluate critical thinking across the curriculum. Further, while teachers are expected to teach critical thinking skills, teachers are rarely taught specifically how to teach these skills.

Georgianna (1995) conducted a study on understanding domain knowledge for teaching: higher-order thinking in pre-service art teacher specialists. This study investigates the higher-order thinking and subject matter understanding of pre-service art specialists. The relationship between art specialists' subject matter understanding and instructional choices is also examined. Individual case study research was conducted on 18 prospective art teachers from a large mid-western state university. The participant-volunteers were visual art or art education majors in the final stages of course work. Qualitative data were triangulated from a series
of oral interviews, lesson-planning activities, personal biographies, university transcripts, and self-reports.

The findings in the study showed that only some pre-service art teachers exhibited the higher-order thinking or indepth understanding expected of specialists in visual art. Most future art teachers displayed overly simplistic thinking, shallow understandings, and superficial domain knowledge. These findings suggest the content knowledge and art understandings possessed by pre-service art teacher specialists should not be taken for granted. Successful completion of required coursework does not guarantee higher-order thinking or deep understanding of the domain.

Skinner, Foulds and Cousins (1994) conducted a study on the effect of intervention strategies on creative thinking skills of pre-service teachers. The purpose of the study was to examine the effect of intervention strategies on creative thinking skills of pre-service teachers. A cohort of first year pre-service primary teachers was pre-tested and divided into an experimental and a control group, with all six classes receiving the same basic science education course for the semester. In addition, the experimental group also received instruction in the use of selected creative thinking strategies. In the last two weeks of the semester the three tests were administered again to the cohort as a post-test. The three tests used were the TCT-DP drawing test (Urban & Jellen, 1986), the IOWA Creative Thinking Assessment Model (Yager, 1991), and the Creativity Inventory (Williams, 1972).
The findings in the study showed that, for two of the three measures of creativity used in this research it can be seen that there were statistically significant gains made by the experimental group which are inferred to be a direct result of the creativity intervention strategies employed. For the IOWA test, the large increase in the numbers of unique responses (110%) supports the hypothesis that intervention strategies do enhance creativity. The findings for the third measure (TCT-DP) are not consistent with those of the other two measures: the gain in scores was small and not statistically significant, while the control group displayed a large and significant gain. In order to explain the unexpectedly large increase in TCT-DP scores by the control group one would need to know how strong the influence of the 'lecturer' variable was compared with the 'Intervention' variable. Appropriate classroom environments are also recognised as a key factor in producing creative behaviour.

Classes (1991) conducted a study on discrete thinking skills in two teachers' physical education. Integrating thinking skills such as focusing, information gathering, and organisation into all subjects is becoming increasingly important in elementary schools. The non-academic subjects of physical education, art, and music can provide opportunities for teaching thinking skills. In this study, 2 physical education programmes (8 classes) were examined for the presence of opportunities to use thinking skills. The programmes were taught by 2 expert physical education teachers at different schools using the logsdon physical education curriculum. Data were analysed using constant comparison.
The findings in the study showed that teachers used deductive and inductive strategies associated with teacher-and student-structured experiences to encourage student metacognition. Properties of the data categories represented discrete thinking skills, such as attention focusing, comparing, and analysing, typically associated with thinking-readiness experiences.

Swing, Stoiber and Peterson (1988) conducted a study on thinking skills versus learning time: effects of alternative classroom-based interventions on students' Mathematics problem solving. This study examined the effects that teaching fourth-grade teachers (N = 29) to use one of two classroom-based interventions had on students' mathematics achievement. In the thinking skills intervention, teachers received instruction in how to teach their students the cognitive strategies of defining and describing, thinking of reasons, comparing, and summarising. In the learning time intervention, teachers received instruction in how to increase students' engagement and academic learning time. All students completed a vocabulary test and mathematics achievement pre-tests in December and the same mathematics tests again in May. Observers coded teachers' instructional behaviour and students' engagement before and after the intervention. Twelve students from each class were interviewed in May to obtain verbal protocols of students' use of the thinking skills.

The findings in the study showed that lower ability classes did better in the learning time intervention than in the thinking skills intervention, whereas higher ability classes did better in the thinking skills intervention than in the learning time intervention. Observations and transcripts of classroom interactions
showed that thinking skills teachers of lower ability classes were less effective in implementing thinking skills than were teachers of higher ability classes. Within class, the lower ability students benefited more from the thinking skills intervention than from the learning time intervention, perhaps because the interventions gave these students cognitive strategies that they did not already have; once provided with these strategies, however, these students were then able to use them in mathematics problem solving.

(ii) Indian Studies

Sibichen and Annaraja (2010) conducted a study on critical thinking and decision making skills in teaching: a paradigm shift. The objectives of the study were to find out (i) whether there is any significant difference between male and female secondary teacher education students in their critical thinking and decision making skills (ii) whether there is any significant difference between graduate and post-graduate secondary teacher education students in their critical thinking and decision making skills and (iii) whether there is any significant difference among English, Social science, Mathematics, Natural science and Physical science secondary teacher education students in their critical thinking and decision making skills. The method adopted in the study was survey. The investigator used stratified random sampling technique for selecting the sample. The sample of the study is secondary teacher education students studying in the B. Ed. colleges affiliated to Mahatma Gandhi University, Kottayam. The tool used was Thinking Skill Assessment Scale developed by Sibichen and Annaraja (2009).
The findings in the study showed that there is no significant difference between male and female secondary teacher education students in their critical thinking and decision making skills, there is significant difference between graduate and post-graduate secondary teacher education students in their decision making skill and there is no significant difference among English, Social science, Mathematics, Natural science and Physical science secondary teacher education students in their critical thinking and decision making skills.

Sibichen (2010) conducted a study on thinking skills of secondary teacher education students. The objectives of the study were to find out (i) whether there is any significant difference between male and female secondary teacher education students in their critical thinking, creative thinking, logical reasoning, problem solving, decision making, lateral thinking and thinking skills, (ii) whether there is any significant difference between graduate and post-graduate secondary teacher education students in their critical thinking, creative thinking, logical reasoning, problem solving, decision making, lateral thinking and thinking skills, (iii) whether there is any significant difference between secondary teacher education students who have attended computer course and who have not attended computer course in their critical thinking, creative thinking, logical reasoning, problem solving, decision making, lateral thinking and thinking skills, (iii) whether there is any significant difference among English, Social science, Mathematics, Natural science and Physical science secondary teacher education students in their critical thinking, creative thinking, logical reasoning, problem solving, decision making, lateral thinking and
thinking skills. The survey method was adopted in the study. Stratified random sampling technique was used for selecting the sample. The sample of the study is secondary teacher education students studying in the B. Ed. colleges affiliated to Mahatma Gandhi University, Kottayam. The tool used was Thinking Skill Assessment Scale developed by Sibichen and Annaraja (2009).

The findings in the study showed that there is no significant difference between male and female secondary teacher education students in their critical thinking, creative thinking, logical reasoning, problem solving, decision making, lateral thinking and thinking skills, there is no significant difference between graduate and post-graduate secondary teacher education students in their critical thinking, creative thinking and problem solving skill. But there is significant difference between graduate and post-graduate secondary teacher education students in their logical reasoning, decision making, lateral thinking and thinking skills and there is no significant difference between secondary teacher education students who have attended computer course and who have not attended computer course in their critical thinking, creative thinking, logical reasoning, problem solving, decision making, lateral thinking and thinking skills and there is no significant difference among English, Social science, Mathematics, Natural science and Physical science secondary teacher education students in their critical thinking, creative thinking, logical reasoning, problem solving, decision making, lateral thinking and thinking skills.

Satish (2002) conducted a study on preparation of a creativity programme for pre-service teacher trainees at primary level and a study of its effectiveness. The
objectives of the Study were (i) to construct and standardise a creativity test for pre-service teacher trainees at primary level, (ii) to identify the creativity level of pre-service teacher trainees at primary level, (iii) to prepare a creativity programme for pre-service teacher trainees at primary level and (iv) to study the effectiveness of creativity programme with respect to creativity components, caste category; and academic stream. Pre-test, post-test, experimental and control group design has been employed for the study. An initial sample of 10 pre-service teacher trainees who were studying in the first year during 97-98 in DIET-Kathlal (Dist. Kheda) was drawn for pilot administration of the tool to identify the creativity level. For final administration of the tool, the whole class of the first year primary school teacher education (1998-99) of DIET, Vadodara (40 trainees) were selected as the sample. For studying the effectiveness of the creativity programme the total number of trainees studying in the first year primary school teacher education during 1999-2000 of DIETS–Rajpipla (Dist. Narmada) and Santrampur (Dist. Panchmahal) were selected as the sample for the phase 2 of the study. 46 trainees of Rajpipla were treated as experimental group, whereas 43 trainees of Santrampur were treated as control group. The tools used were a test of creativity to identify the creativity level of pre-service teacher trainees and a creativity programme. The test of creativity was in both the forms verbal and non-verbal. The verbal form included three types, namely, imaginative events, novel uses of the things and similarity. The non-verbal form of the test included three types of activities, namely, picture construction, picture completion and circles and rectangles.
The findings in the study showed that: (i) the mean effect of the treatment in terms of a creativity programme on the primary school student teachers was found significant for the creativity and its components namely fluency, flexibility, originality and elaboration, respectively. (ii) there was no significant difference in the mean creativity scores of the teacher trainees of different caste categories in case of the experimental group. (iii) there was no significant difference in the mean creativity scores of the teacher trainees of different academic stream in case of the experimental group and (iv) No interaction effect of caste category and academic stream was found on the mean creativity score of the primary school student teachers of the experimental group.

CRITICAL REVIEW

The investigator reviewed 68 studies related to the variables techno-pedagogical skills and thinking skills. Among which 61 were conducted in abroad and 7 in India. Most of the studies have employed survey method. In many of the studies random sampling techniques have been used for selecting sample.

The investigator would like to add the following critical comments starting with the variable techno-pedagogical skills. After a critical evaluation of the studies related to techno-pedagogical skills, the investigator has made the following conclusions.

Lambert and Gong (2010) concluded that pre-service teachers became less anxious about computers, their belief in the value of using technology to enhance teaching and learning as well as their self-efficacy toward integrating
technology in the classroom significantly improved, and they became more advanced in their technical skills and knowledge of how to apply these skills in the classroom.

Jeong & Kim (2009) found out that pre-service teachers were unable to translate pedagogical content knowledge into pedagogically sound technology integrated lessons. Mamadou (2009) suggested that no teacher training programmes exist to provide techno-pedagogical skills linked to the school curriculum or to the subject being taught. Rather, teachers are trained to use computers and certain applications without linking their use to teaching.

Zemat (2008) found out that pre-service teachers were able to use practical and creative reasoning with the help of technology environment.

Thierry (2007) concluded that Information and Communication Technologies help student teachers to face pedagogical challenges encountered during their practice teaching. Pasternak (2007) found out those teacher candidates were integrating technology into ELA practice explored new illiteracies through new media.

Mishra and Koehler (2005) found out that learning by design of online course appears to be an effective instructional technique to develop deeper understandings of the complex web of relationships between content, pedagogy and technology and the contexts in which they function.

Ellis (2003) found out that teachers do not have the skills to effectively integrate computer based technology in the classroom.
Diane (2002) found out the value and benefits associated with using Information and Communication Technology in the field based components of pre-service teacher education.

Duphorhe and Orth (2000) found out that computer conferencing designs show higher critical thinking skills. Luke (2000) concluded that teaching with technology can not be separated from teaching. Montgomery (2000) found out that teachers with experience in teaching with technology have much to offer on understanding of teaching computer related technology.

Peterson, Fennema, Crpenter and Loef (1989) found out positive relationship among teachers’ belief, knowledge and students’ problem solving achievement.

After a critical evaluation of the studies related to thinking skills, the investigator has made following conclusions.

Fahmi and Hmoud (2010) concluded that EFL teachers should be allowed pre-service and in-service training opportunities to encourage the development of critical thinking. Sibichen and Annaraja (2010) concluded that there is no significant difference between male and female secondary teacher education students in their critical thinking and decision making skills, there is significant difference between graduate and post-graduate secondary teacher education students in their decision making skill and there is no significant difference among English, Social science, Mathematics, Natural science and Physical science secondary teacher education students in their critical thinking and decision making skills.
Choy and Cheah (2009) concluded that teachers perceive they are teaching critical thinking to their students and they believe that critical thinking will provide the intellectual stimuli that will facilitate learning among students. Sendag and Odabasi (2009) concluded that online Problem Based Learning approach had a significant effect on increasing the critical thinking skills of undergraduate students.

Grosser and Lombard (2008) suggested that a considerable number of the samples of prospective teachers are not able to execute critical thinking skills in classrooms. Kong (2008) concluded that critical thinking dispositions of the pre-service teachers who have been exposed to the thinking module can be improved and thus such inclination towards critical thinking can cause the teachers to be more critical in their approach to academic problem or classroom management problems. Charles (2008) found out that teaching strategies employed by teacher trainers, classroom environment, administrative issues like students' recruitment, large class sizes, staff development, and examinations, nature of the school system school/culture of the society, and documents do not support the enhancement of the thinking skills of pre-service teachers and there should be a collaborative effort among all who are involved in the preparation of pre-service teachers.

Ruth and Jean (2008) concluded that it is the skill and the professional knowledge of the teacher who mediates the interaction, and facilitates the development of pupils' creative responses at the interface of technology, which is critical to the enhancement of the whole-class teaching and learning processes.
Ya-Ting & Heng-An (2008) concluded that there is a positive relationship between critical thinking skills and critical thinking dispositions through different online instructional strategies. Sezer (2008) suggested that integration of critical thinking skills in teacher preparation course in mathematics can have positive effects on students' attitudes and achievement in mathematics.

Greensfeld and Lehman (2004) concluded the discrepancy between the declared views of thinking skills held by teachers and their active use. Mahyuddin, Pihie, Elias and Konting (2004) concluded that teachers incorporated critical thinking skills, creative thinking skills as well as convergent/divergent thinking skills in their teaching. The result of this study also showed that the vocational/technical and science and mathematics teachers were incorporating the thinking skills as compared to language teachers. Ulker and Seher (2004) concluded that timing and classroom management were major motives for student teachers to make instant decisions and experienced teachers were more concerned about discipline problems.

Georgiana (1995) concluded that only some pre-service art teachers exhibited higher order thinking or in-depth understanding expected of specialists of visual art. Melancon, Shaughnessy, Acheson, Gaedke and Moore (1997) concluded that few teachers, programmes, and institutions actively integrate, assess, teach, and evaluate critical thinking across the curriculum and teachers are rarely taught specifically how to teach these skills.

The present study differs from the rest of the studies in several ways. First of all, there was no study undertaken so far which had combined the variables of
techno-pedagogy and thinking skills. Therefore, the present study is the first of its kind in this regard.

Secondly, it could be said that, there were plenty of foreign studies that dealt with techno-pedagogical skills of pre-service teachers, but very few studies directly dealt with secondary teacher education students. Hence this study stands singular unlike the earlier studies in this regard.

Thirdly, the present study is unique and differs from the rest of the studies in terms of population and sample. It is also found from the above studies that none of them directly dealt with the relationship between techno-pedagogical and thinking skills of the secondary teacher education students.