CHAPTER II

REVIEW OF RELATED STUDIES

2.1 INTRODUCTION

Review of literature is a “critical analysis of a segment of a published body of knowledge through summary, classification, and comparison of prior research studies, reviews of literature and theoretical articles” (University of Wisconsin Writing Center). “A familiarity with the literature of any problem helps the students to discover what is already known, what others have attempted to find out, what methods remain to be unsolved” (Best, 1978). Therefore a researcher has to survey the available literature relating to his field of survey. This step helps to eliminate duplication and replication of research done earlier and provides useful hypotheses and helpful suggestions for significant investigations. It provides adequate information related to the present study. It also helps in interpretation of the results of the present study.

The researcher has gone through foreign studies and relevant studies made in India. In order to get a clear idea of the study, the researcher has gone through a number of books, journals, research abstracts, theses, online research databases namely ProQuest, ERIC, EBSCO, Elsevier, Shodhganga and Dissertation Abstracts International. Here the researcher has classified and presented the studies related to metacognition, ICT awareness and academic achievement.
2.2 STUDIES ON METACOGNITION

The researcher reviewed and abstracted 20 studies conducted in metacognition.

Leader (2008) compared metacognition among students identified as gifted or non-gifted using the DISCOVER assessment. No significant differences were found among the types of metacognitive knowledge studied. Statistically significant differences were found, with gifted children demonstrating greater ability to articulate their metacognitive knowledge.

Chwee, Timothy, and Ching (2010) studied profiling pre-service teachers’ awareness and regulation of their own thinking: evidence from an Asian country. No significant difference was found by educational level on all subscales except for evaluation. There were no significant mean differences by gender. The results indicated that the mean scores for all subscales were significantly different by teaching experience, except for monitoring and procedural knowledge.

Wilson and Bai (2010) explored the relationships and impact of teachers’ metacognitive knowledge and pedagogical understandings of metacognition. The results showed that the participant’s metacognitive knowledge had a significant impact on their pedagogical understanding of metacognition. There were significant relationships among participants’ conditional knowledge, declarative knowledge, and procedural knowledge as parts of their pedagogical knowledge of the metacognition.

Emine, Polat, Neset, and Vesile (2011) explored the metacognitive awareness of pre-service teachers. Results reported that knowledge of cognition was significantly higher than regulation of cognition. Mean differences between knowledge of cognition and regulation of cognition factors were found significant. Males were
tended to have lower grade point average (GPA) scores. Academic success was related to regulation skills. As the GPAs of pre-service teachers increased, their planning and monitoring awareness developed.

Fazal (2011) assessed the science teacher’s metacognitive awareness and its impact on the performance of students. Results indicated that metacognitive awareness was correlated with internet use and library habits. Children of highly educated parents were highly metacognitively aware than less educated parents. There was no significant difference in the metacognitive awareness of male and female students. But male teachers on MAI were higher than female teachers. Teachers with more than 15 years experience possessed higher scores on metacognition. Teachers with higher professional qualifications achieved higher score on the MAI. Students whose teachers have high metacognition had a higher mean score both on the chemistry test and metacognitive inventory.

Sheeja and Annaraja (2011) investigated the teaching competency of secondary teacher education students in relation to their metacognition. The findings showed that there was significant difference between sex and locality of secondary teacher education students in their metacognition. Male and female secondary teacher education students differed significantly in their metacognition. Female students were better than the male students. Rural and urban college secondary teacher education students differed significantly in their metacognition. Urban college students were better than the rural college students.

Alci and Yuksel (2012) examined the self-efficacy, metacognition and academic performance of pre-service ELT students: prediction and difference. There were significant correlations among performance, teacher’s self-efficacy and
metacognition. The correlation between metacognition and GPA was high. The regression analysis showed that metacognitive awareness predicts academic performance. There were significant differences in metacognitive awareness according to the grades.

Kapadia and Garg (2012) studied the relation of metacognition of secondary school students with their perceived teacher competencies. A significant difference in metacognition was found between male and female secondary school students. Female students were found to possess better metacognition than male students. A significant and positive correlation was found between total metacognition and total teacher competency scores.

Omidi and Sridhar (2012) investigated the effectiveness of performance assessment on metacognitive skills. Results showed that there was significant influence of performance assessment on all dimensions of metacognitive skills. In all the dimensions, metacognitive skills in traditional assessment group scored significantly lesser than the performance assessment group. Also boys and girls do not differ in their scoring on metacognitive skills, in all the dimensions.

Jayapraba (2013) compared the metacognitive instruction and co-operative learning strategies for promoting insightful learning in science. Results revealed that the metacognitive instructions were most effective in enhancing academic achievement. Multiple regression analysis showed that there was significant relationship between metacognitive awareness and achievement.

Rani and Govil (2013) examined the metacognition and its correlates. The findings revealed that gender had no significant impact on the metacognition of UG students.
The metacognitive level of urban students differed significantly from their rural counterparts. The high and low achieving UG students differed significantly on their metacognitive level. Moreover, fathers’ educational qualification found to have no significant impact on metacognition of the students under study, while mothers’ education has significant impact on it.

Anandaraj and Ramesh (2014) studied the relationship between metacognition and problem solving ability of Physics major students. The findings revealed that the level of metacognition of Physics major students were moderate with regard to gender, locale of the student and locale of the college. There was no significant difference between Physics major students in their metacognition with regard to the locale of the college. But, there was a significant difference between Physics major students in their metacognition with regard to their gender and locale of the student. The study revealed that the female and urban area students were better in their metacognition.

Goudarzi and Ghonsooly (2014) studied the relationship between metacognitive awareness and self-efficacy and their effects on test performance of Iranian EFL learners. The findings showed that there were significant differences between the 3 groups (low, average and high) of metacognitive awareness in their effects on test performance. Learners with high metacognitive awareness performed statistically better than average and low groups.

Choudhury and Chowdhury (2015) compared the teaching competency of secondary teacher educators in relation to their metacognition awareness. Majority of both male and female teacher educators had average level of metacognition awareness. The study revealed that there was a significant difference between male and female teacher educators in their metacognition awareness. Mean score of male teacher
educators were better than female teacher educators in their metacognition awareness. There was a significant difference between rural and urban secondary teacher educators in their metacognition awareness. Mean score of urban teacher educators were better than rural teacher educators in their metacognition awareness.

Mai (2015) explored the science teacher’s self perception about metacognition. The results revealed that the science teachers had a high level of perception about metacognition. No significant differences were found related to teacher’s gender or age.

Veloo, Rani, and Hashim (2015) assessed the matriculation college students’ Metacognitive Awareness Reading Strategies (MARS) in Biology. Correlation analyses showed that the overall strategies and all the sub strategies were positively correlated with Biology achievement.

Aydin (2016) analysed the relationship between high school students' self-efficacy, metacognitive strategy use and their academic motivation to learn Biology. Results showed that the highest correlation was found between self-efficacy and the use of metacognitive strategies. The use of metacognitive strategies made a positive and significant prediction of students' intrinsic motivation to learn biology.

Ridlo and Lutfiya (2017) studied the correlation between metacognition level with self- efficacy of Biology education college students. Most college students had a high level of metacognition. Results showed that metacognition level and self- efficacy had a weak relationship. Self-efficacy was influenced by metacognition.
Coskun (2018) studied the metacognitive thinking skills of university students. The results showed that university students possessed higher levels of metacognitive thinking skills. There was an increase in the level of metacognitive thinking skills as the class level increase. Student’s metacognitive thinking skills differed across gender. Female students were able to control their thinking processes better than male students.

Hoy (2018) explored the emotion and metacognitive monitoring: The role of emotion in the development of learning belief. The results showed a relationship between emotion and beliefs formed during metacognitive monitoring.

### 2.3 STUDIES ON ICT AWARENESS

The researcher reviewed and abstracted 27 studies conducted in ICT awareness.

Rajasekar and Vaiyapuri (2007) studied the higher secondary school teachers’ computer knowledge and their attitude towards computer. The findings of the study were: (i) Majority of teachers belonged to the low level of computer knowledge. (ii) There was a significant difference in computer knowledge of teachers’ w.r.t gender. The female teachers were better than males. (iii) There was significant differences in computer knowledge of teachers’ w.r.t locality. Urban school teachers were better than rural teachers. (iv) There was no significant difference in computer knowledge between the Government school and private schools teachers. (v) There was a significant difference in computer knowledge between the graduate and postgraduate teachers. The postgraduate teachers are found to be better than the graduate teachers. (vi) There was a positive relationship between the computer knowledge and the attitude towards computer of the higher secondary school teachers.
Rao (2008) investigated the access, awareness and use of media support services, strategies to make them popular with learners. The findings of the study were: (i) There was difference in the access and awareness of media infrastructure for students at home. (ii) Only radio, tape recorder, television and telephone were available for the majority of respondents at home.

Sami (2009) examined the use of electronic information services (EIS) in research libraries. The findings of the study were: (i) Most of the users were not aware of many of the electronic information services. 47.6% of non-technical users were not aware of even Internet. (ii) 66.7% of the non-technical staff found the use of electronic services to be difficult. (iii) Print media still appeared to be a preferred media than internet.

Siddique and Abraham (2010) explored the availability and use of ICT in schools in Delhi. 71.5 per cent of the schools had internet connection. The dropout rate in the schools decreased due to the effect of ICT on students. The enrolment of students in schools with ICT facility increased. ICT has helped in improving the results of the students in the terminal examination. 35.25 per cent of the total teachers had no training in computer.

Gulhane (2011) explored integrating ICT in teacher education. The study revealed that there was no significant difference between the theoretical and application awareness regarding ICT among male and female teacher trainees. After implementing the ICT training module, significant changes were found among teacher trainees. A large number of trainees were found to use ICT and Internet for their seminars and assignments. Significant changes were also found in their email habits.
Onasanya, Shehu, Ogunlade, and Adefuye (2011) explored the teacher’s awareness and extent of utilization of information communication technologies for effective science and health education in Nigeria. The analysis that the level of computer literacy of the science teachers examined was low. Their level of utilization of ICT resources was also found to be very low. The males belonged to higher computer literacy level than the females. The result showed that there was a significant difference between male and female science teachers in their level of computer literacy and utilization of ICT’s. It also indicated that the males outperformed their female counterparts in both instances.

Beena and Mathur (2012) studied the ICT awareness of M.Ed. trainees. Majority of the aided and self financing management training college M.Ed. trainees were having average knowledge about ICT. There was significant difference between male and female M.Ed. students in their ICT awareness about use of ICT in education. Male M.Ed. students possessed significantly higher awareness of ICT in education than female M.Ed. students. But there was no significant difference between the types of management of M.Ed. students in their ICT awareness in education.

Francisca (2012) investigated the ICT competency of teacher trainees. The findings of the study were: (i) the teacher trainees had moderate competency in ICT w.r.t. gender, age, subject, qualification, type of institution and nature of institution. (ii) the male and female trainees significantly differed in basic computer skills and internet knowledge. (iii) the trainees do not differ significantly in ICT competency with respect to their age. (iv) there was significant difference in subject and qualification of the trainees in their ICT competency. Trainees with PG qualification were better competent than UG trainees and similarly the science student teachers were better
competent than the Arts student teachers. (v) the trainees significantly differed in their competencies and internet knowledge with respect to their type of institution. Trainees of aided colleges had better competencies than the trainees of self financing colleges. (vi) the trainees significantly differed in their competencies and internet knowledge with respect to the nature of institution.

Sahni (2012) explored the knowledge of computers among prospective teachers. Results indicated that (i) most of the prospective teachers had moderate level of knowledge of computers; (ii) there was significant difference in knowledge of computers among prospective teachers with respect to type of college, gender and attitude towards computers. (iii) knowledge of computers was higher in case of prospective teachers of aided colleges than self-financing colleges. (iv) knowledge of computers was more in case of male than females. (v) knowledge of computers was more in case of prospective teachers having favourable attitude towards computers. (vi) male prospective teachers of aided colleges and self-financing colleges had more knowledge of computers than females (vii) male and female prospective teachers of aided colleges had higher knowledge of computers than male and female prospective teachers of self-financing colleges.

Sinha (2012) explored ICT and internet awareness and access to e-resources under UGC-INFONET digital library consortium: a survey of Assam university library users. The awareness of ICT, internet and access to e-resources was comparatively lesser in female participants. Most of the library users were aware of ICT and internet usage for their academic activities.
Thakor (2012) investigated ICT as a value added tool for quality teaching/learning. Majority of teachers were very passive towards ICT usage. This study found that students of masters were generally favorable to the use of ICTs. Regarding the overall computers and internet usage, majority of the students accessed these facilities off campus. The study revealed that teachers as well as students have a positive attitude towards the use of ICT in teaching/learning process. Majority of teachers and students had the basic skill of computer operation.

Babu (2013) explored the ICT and CCE awareness among secondary school students. There was significant difference between boys and girls with regard to awareness towards ICT and CCE. Boys had more awareness towards ICT and CCE than girls. There was a significant difference between VII and VIII std students with regard to awareness towards ICT and CCE. VIII std students had more awareness towards ICT and CCE than VII std students.

Hanbay (2013) studied the relationship between web-based learning time outside the classroom and academic achievement in German as a tertiary language by the students on vocational high schools. It was found out that there was a significant relationship between web-based learning time and academic achievement in German as a tertiary language. There was a significant difference in the academic achievement scores between the two groups.

Kyriakides (2014) studied the Cyprus university of technology students' attitudes towards technology and the frequency and type of educational technology used during academic courses. Findings: Students indicated that technology elevates the level of teaching and that technology assisted students in achieving their academic goals.
Thakur (2014) studied the awareness of trained teachers in relation to information and communication technology. Results revealed that overall the level of ICT awareness was poor. There was no significant difference in the level of ICT awareness among the male and female trained teachers and there was a significant difference between the urban and rural trained teachers.

Yemisi et al. (2014) investigated the availability and utilization of information communication technology resources for distance education students: a case study of Emmanuel Alayande college of Education, Oyo, Nigeria. Findings: Mobile phones and internet were the most accessible devices to the distance education students. Majority of students used ICT to enhance their academic performance.

Amutha and Kennedy (2015) investigated the awareness on technology based education by the student teachers. The study found that there was no significant difference in intellectual domain of student teachers based on gender. With regard to the educational qualification (UG and PG) there was no significant difference among student teachers based on intellectual and emotional domains. As far as the type of family (Nuclear and Joint) there was no significant difference among student teachers based on intellectual and emotional domains.

Belo and Ye (2015) studied the ICT facility, readiness and teachers’ use of ICT facilities in technical high schools. Findings: ICT facilities were not available in most of the schools. Majority of the teachers were not competent in the use of ICT.

Jattan and Chaudhary (2015) explored the adoption of ICT in higher education and the students’ perception towards ICT. Results showed that all the students were
having the knowledge of computer and internet. They had no difficulty to use the computer and internet.

Akpojotor (2016) studied the awareness and usage of electronic information resources among postgraduate students of library and information science in southern Nigeria. The results revealed that postgraduate students were highly aware of electronic information resources and used them to a very large extent. They were also highly skilled in using them. There was also a significant relationship between their ICT skills and their usage of electronic information resources.

Ani et al. (2016) explored the strategies for enhancing the utilization of ICT based library resources in research. The findings revealed that postgraduate student's lack of fund, high cost of internet use, the incompetence of library staff, lack of access to ICT resources, lack of ICT skills by users and lack of awareness of ICT-based library resources are the challenges affecting the use of ICT-based library resources.

Paul (2016) studied the higher secondary teachers’ attitude towards the use of ICT in teaching learning process. The results indicated that the male and female teachers differed significantly in their attitude towards using new technology. Government and private school teachers do not differ significantly in their attitude towards using new technology.

Philomina and Amutha (2016) explored the ICT awareness among teacher educators. The results indicated that Indian teacher educator’s awareness towards ICT differed regarding gender and subject. Female teacher educators had more awareness towards ICT than male teacher educators. Science teacher educators had more awareness
towards ICT than arts teacher educators. When compared with M.Ed. and M.Phil. scholars, Ph.D. scholars surpassed others in their ICT awareness.

Verma and Dahiya (2016) studied the gender difference towards information and communication technology awareness in Indian universities. There was no significant difference between boy and girl student’s opinions towards ICT awareness. There was no significant difference between male and female faculty’s opinions towards ICT awareness. There was no significant difference between overall male and female’s opinions towards ICT awareness.

Jagadesh (2017) investigated the ICT tools usage among faculty of education in teaching learning processes. The usage of Windows office ranked the highest in curriculum transaction, presentations, e-assignments etc. It was followed by computers, mobile apps and digital scanners/printers. The least used ICT tools among the faculty were podcast, blogs and GPS/GIS technologies in classrooms.

Payal and Kanvaria (2018) explored learning with ICT: use & barriers from teachers’ perceptions. The results showed that the key issues and barriers found to be significant in using ICT tools by teachers were: limited accessibility and network connection, limited technical support, lack of effective training, limited time and lack of teaching competency.

Valtonen, Kukkonen, Kontkanen, Makitalo-Siegl, and Sointu (2018) studied the differences in pre-service teachers' knowledge and readiness to use ICT in education. Statistically significant differences between the 4 clusters were found in all the TPB areas except subjective norms. These results provide insights into the differences among pre-service teachers in the context of TPACK and the TPB.
2.4 STUDIES ON ACADEMIC ACHIEVEMENT

The researcher reviewed and abstracted 26 studies conducted in academic achievement.

Jebraj and Mohanasundaram (2008) explored the effectiveness of e-content in teaching of Physics at tertiary level. The male as well as female trainees in the experimental group and control group differed in their achievement. Trainees belonging to the science and humanities faculty differed in their achievements.

Vishwakarma (2008) studied the impact of school environment on learning behaviour and academic achievement of the students of Chhatarpur district. The findings of the study were: The impact of school environment on academic achievement of the boys and girls of the urban government upper primary schools was higher.

Devi (2009) studied the relationship between problem solving ability and academic achievement of secondary school students. The findings of the study were: (i) there was significant difference in academic achievement of students with high, moderate and low problem solving ability. (ii) there was a positive relationship between problem solving and academic achievement of students.

Dhall and Thukral (2009) explored the intelligence as related to self-confidence and academic achievement of school students. The results of the study revealed that there was a significant relationship between academic achievement and intelligence of secondary school students. There existed significant differences between secondary school boys and girls in terms of academic achievement.
Vitasari, Wahab, Othman, Herawan, and Sinnadurai (2010) explored the relationship between study anxiety and academic performance among engineering students. The results showed that there was a significant correlation of high level anxiety and low academic performance among engineering students.

Kumar and Kumar (2011) investigated the psychological stress in relation to achievement among male and female science students. Results showed that both male and female science students significantly differed on psychological stress and achievement.

O’Brien (2011) studied thefacebook and other internet use and the academic performance of college students. Results indicated that students devote a significant amount of time to both academic and recreational internet activities, and facebook. Regression analysis revealed no significant relationship between internet and facebook usage patterns and academic performance.

Panda and Behera (2011) studied the achievement and personality pattern of secondary level scheduled tribe students in relation to gender and type of institutions. The study revealed that (i) the residential secondary school students scored better than non residential students in aggregate achievement. (ii) the non government secondary school students performed better than government school students. The non government secondary school students were found to have higher level of mean academic achievement than government secondary school students.

Mohapatra (2013) studied the academic achievement of tribal & non-tribal students in relation to their self-concept, level of aspiration, adjustment and achievement motivation. The findings of the study were: (i) the academic achievement of the tribal
students was found to be significantly lower than that of the non-tribal students. (ii) there existed a positive correlation between academic achievement and self-concept, level of aspiration, adjustment and achievement motivation of tribal students.

Benipal and Singh (2014) studied the academic achievement of adolescents in relation to their perception of classroom environment in Punjab. Results revealed that there was a significant relationship between academic achievement and classroom environment with respect to locality and gender. Academic achievement of urban students was greater than that of rural students and was in favour of male. Urban female student’s academic achievement was greater than that of rural female students.

Lal (2014) studied the emotional maturity, self confidence and academic achievement of adolescents in relation to their gender and urban-rural background. The results indicated that there was significant difference between the male and female adolescents on academic achievement. The female adolescents showed better academic achievement as compared to male. On the academic achievement front, the urban adolescents stood better than the rural.

Agrawal and Teotia (2015) studied the academic achievement and self-concept of secondary level students. The findings of the study were: Boys showed better academic achievement than girls. There is significant relationship between self-concept and academic achievement.

Andrabi (2015) studied the academic achievement among tribal and non-tribal adolescents of Kashmir. Results showed that tribal and non-tribal adolescents differ significantly on the measure of academic achievement. Non-tribal adolescents were found to have a higher level of academic achievement than tribal students. The study
also revealed that there was no significant difference between male and female adolescents on the measure of academic achievement.

Kumar (2015) investigated the academic achievement of B.Ed students in relation to intelligence and achievement motivation. The results showed that high intelligence group has significantly higher academic achievement than that of low intelligence group. High achievement motivation group of students had significantly better academic achievement than that of low achievement motivation group of students.

Kumari and Chamundeswari (2015) studied about the emotional intelligence, school environment and academic achievement of students. The results showed that girls were significantly better than the boys in the state and matriculation board schools with respect to school environment and academic achievement.

Tabibzadeh (2015) examined the student academic achievement in college chemistry. The findings of the study were: The study found that student self-efficacy has no influence on student academic achievement.

Chawla (2016) explored the achievement in Chemistry of IX graders in relation to study habits. The results showed that there existed a positive and significant relationship between achievement in Chemistry and study habits.

Moore (2016) studied the relationship between educational achievement and educational aspirations for Latino middle and high school students. The findings of the study were: The educational aspirations and the academic achievement of the students produced relationships of significance during the students' 8th grade year. Participants with educational aspirations of a bachelor's or master's degree had better academic outcomes, than a professional degree (i.e., medical, law).
Nayak (2016) investigated the relationship of extroversion dimension with academic performance of medical students. The results revealed that there was no significant correlation between academic performance and extroversion. Students with high extroversion showed poor academic performance.

Rather (2016) studied the influence of achievement motivation (AM) on academic achievement of secondary school students. The findings of the study were: There was a significant difference between different categories of achievement motivation with respect to academic achievement. It was found that achievement increased with the increase in achievement motivation.

Sorour (2016) investigated the factors affecting scholastic achievement among school children in a slum area. Statistically significant relations were revealed between school achievement and school children’s gender, age, grade, father education, mother age, residence and income.

Alfifi and Abed (2017) studied the factors contributing to students’ academic performance in the education college at Dammam university. English language level had a positive influence on students’ academic performance. The results showed that female perform better than male students. The class size, age, residential area of student, family size, family income and parents’ education level had no significant influence.

Endeley (2017) studied school type and mathematics achievement in English-speaking primary schools in Cameroon: implications for technological development. Results revealed that Mathematics achievement was generally low and differed by school type. With regard to school type, achievement in numeracy differed
significantly with private schools having a better performance than public and confessional schools. Also, there was a significant difference in achievement with regard to location.

Jabeen (2017) compared the teaching aptitude and academic achievement of prospective teachers pursuing B. Ed. course from the distance and the regular mode. The findings showed that there was no significant difference between the prospective teachers of distance mode and regular mode in accordance with their academic achievement.

Pathak and Tiwari (2017) studied the relationship of problem solving ability and academic achievement of higher secondary students. The result revealed that there was positive and significant relationship between academic achievement and problem solving ability.

Zare, Zeinalipoor, and Jahromi (2018) studied the relationship between self-regulated learners strategies with academic achievement. The results indicated that the self-regulated cognitive learning strategies had a significant relationship with students’ academic achievement. The mean self-regulated learning strategies and academic achievement of female students was higher than male students.

2.5 STUDIES ON METACOGNITION AND ACADEMIC ACHIEVEMENT
The researcher reviewed and abstracted 16 studies on metacognition and academic achievement. It is abstracted below.

Young and Fry (2008) studied the metacognitive awareness and academic achievement in college students. Correlations were found between the MAI and
cumulative GPA as well as end of course grades. Scores on the MAI significantly differed between graduate and undergraduate college students.

Suman (2009) studied the learning achievement in science of students in secondary schools in relation to their metacognitive skills and emotional competence. The findings of the study were: (i) boys were having higher metacognitive skills than girls. (ii) boys were having higher learning achievement in science than the girls. (iii) there was significant positive relationship between metacognitive skills and learning achievement.

Balya and Khimnani (2011) explored the metacognition of science stream B.Ed. student teachers in relation to their academic achievement at graduation level. Results indicated significant positive correlation between total score of metacognition and academic achievement of science stream B.Ed student teachers at graduation level.

Dixit (2011) studied the readiness towards the use of metacognition and its relationship with academic achievement of higher secondary students. Results revealed that there was a significant difference in the readiness towards the use of metacognition based on gender differences. However, no significant difference was found in the readiness towards the use of metacognition based on their academic streams. Positive correlation was found between the readiness towards the use of metacognition and academic achievement.

Hrbackova, Hladik, and Vavrova (2012) investigated the relationship between locus of control, metacognition, and academic success. The results showed that metacognition was strongly correlated with academic success.
Chowdhry (2013) studied the relationship between metacognition and academic achievement of secondary students. The findings of the study were: (i) There was significant and positive relationship between Metacognitive ability and academic achievement. (ii) There was a significant and positive relationship between Metacognitive ability and academic achievement of male and female students.

Narang and Saini (2013) studied the metacognition and academic performance of rural adolescents. Results revealed that the subjects with high level of metacognition also performed above average in academics. Metacognition of boys and girls was significantly associated with academic achievement. Majority of boys and girls had high metacognition along with good academic performance. Rural adolescents had both high ‘Cognitive Knowledge’ and ‘Cognitive Regulation’.

Pishghadam and Khajavy (2013) explored the intelligence and metacognition as predictors of foreign language achievement: a structural equation modeling approach. Results showed that the correlation between metacognition and foreign language achievement was higher. In foreign language achievement, metacognition accounted for 17.6% of the variance.

Oz (2014) investigated the relationship between metacognitive awareness and academic achievement among English as a foreign language teachers. The findings revealed that nearly all the students had higher levels of metacognitive awareness. There were significant correlations between metacognitive awareness and grade point average (GPA). Regression analysis revealed that procedural knowledge as well as planning emerged as a significant predictor of GPA. Females had higher mean scores than males in all the dimensions except procedural knowledge. Males and females differed significantly in their metacognitive awareness, with females scoring higher
than males. There were significant differences between overall metacognitive awareness and their GPAs.

Jaleel and Premachandran (2016) studied the metacognitive awareness of secondary school students. There was no significant difference in the metacognitive awareness of secondary school students based on their locale, Gender and type of management of the school.

Mozafari, Safari, Abasifard, Safari, and Sharafi (2016) assessed the dimension of metacognitive skill and its relationship with academic achievement in high school students. Results: There were correlation between metacognitive skills and three of its components (planning, regulation, control and monitoring) and academic achievements. There were significant differences among metacognitive skills and its components in predicting the academic achievement. The control and monitoring skills component had a significant explain for academic achievement of high schools students. But the other 2 components were not significantly effective.

Cetin (2017) investigated the metacognition and self-regulated learning in predicting university students' academic achievement in Turkey. Findings indicated that the GPAs of students did not significantly correlate with metacognition scores.

Das (2017) explored the relationship between metacognitive ability and academic achievement of B.Ed. students - a study. There was difference in the mean of metacognitive ability of male and female B.Ed students and females were higher than the male students. Significant difference has been observed between rural and urban teacher trainees. The mean of urban area were found to be higher than the rural area. Significant difference in metacognitive ability existed between students of graduate
and post graduate level. Metacognitive ability of post graduate students was found to be higher than the graduate students. No significant difference has been observed between the students of private and govt. teacher training colleges in their metacognitive ability. There was significant positive relationship between metacognitive ability and academic achievement of the B.Ed. students.

Sonowal and Kalita (2017) studied the metacognitive awareness and academic achievement of higher secondary level students of Dibrugarh town of Assam, India. Results revealed that, there was a positive correlation between metacognitive awareness and academic achievement but there was no significant difference between male and female students, between students of provincialised and private institutions with respect to metacognitive awareness.

Saeedzadeh, Raeisoon, and Mohammadi (2018) investigated the relationship between cognitive and metacognitive strategies and academic achievement of students of Birjand university of Medical Sciences. The results showed a significant difference between cognitive and metacognitive strategies with academic achievement. There was a statistically significant relationship between gender and academic achievement of the students and between the faculty that they belonged to with meta-cognitive strategies and academic achievement.

Singh (2018) studied the metacognitive ability of commerce students in relation to academic achievement. The findings of the study were: Male and female students do not differ in their metacognitive ability. There is significant relationship between metacognitive ability and academic achievement.
2.6 STUDIES ON ICT AWARENESS AND ACADEMIC ACHIEVEMENT

The researcher reviewed and abstracted 6 studies on ICT awareness and academic achievement. It is abstracted below.

Park, Khan, and Petrina (2009) investigated the ICT in science education: a quasi-experimental study of achievement, attitudes toward science, and career aspirations of Korean middle school students. Findings include: (i) the lowest achievement group showed the most significant improvement after CAI. (ii) boys tended to perform better with CAI than girls.

Okorie (2010) examined the ICT and educational performance: the inter-relationship of selected critical variables. The findings of the study were: There was significant relationship between internet usage and the sex of the students. There was significant relationship between internet usage and academic performance as well as between internet knowledge and the academic performance of the students.

Khedekar and Magre (2011) investigated the awareness on ICT and academic performance of secondary students - a comparative study. There was a significant difference in the level of awareness and academic performance of SSC and CBSE school students. Use of internet by CBSE students was more than SSC board students. It proved that type of institution influenced the academic performance of secondary students.

Erdogdu and Erdogdu (2015) investigated the impact of access to ICT, student background and school/home environment on academic success of students in Turkey. The findings of the study were: (i) availability of internet connection at home or school and student's possession in their own room at home had positive impacts on
academic success (ii) there was a positive relationship between education level of
parents and student's performance at school.

Muhammad and Prema (2017) studied the awareness on ICT and academic
achievement of senior secondary school students in Tarauni and Nassarawa local
government areas of Kano state, Nigeria. Results revealed that (i) the level of
awareness about ICT was high (ii) the level of academic achievement was average
(iii) there was a significant difference in the mean scores of ICT awareness and
academic achievement based on (a) Gender (b) Branch of study and (iv) there was a
significant relationship between awareness about ICT and academic achievement of
senior secondary school students.

Basri, Alandejani, and Almadani (2018) investigated the ICT adoption impact on
students’ academic performance: evidence from Saudi Universities. The findings
revealed that there existed a relationship between ICT adoption and academic
performance. ICT adoption resulted in the improvement of the performance of female
students more than the male. However, students’ of IT major was found to be making
no impact on students’ academic achievement.

2.7 CRITICAL REVIEW OF RELATED LITERATURE

The researcher has reviewed totally 95 studies. Among them 20 were related to
metacognition, 27 were related to ICT awareness, 26 were related to academic
achievement, 16 were related to metacognition and academic achievement and 6 were
related to ICT awareness and academic achievement. Apart from review of related
literature, the researcher would like to add critical comments on the variables
metacognition, ICT awareness and academic achievement. The major findings of the
reviewed studies were synthesized as below.
Metacognition

After critical evaluation of related studies related to metacognition, the researcher had made the following conclusions. The studies proved that metacognition influenced the teaching and learning process.

The reviewed studies reported that the level of metacognition of teachers as well as students was very high (Oz, 2014; Mai, 2015; Ridlo & Lutfiya, 2017; Coskun, 2018). Emine et al. (2011) contradicted that more than half of the students had low scores in metacognitive awareness. Also Choudhury and Chowdhury (2015) opposed that majority of both male and female teacher educators have average level of metacognition awareness.

Wilson and Bai (2010) concluded that there were significant relationships among participants’ conditional knowledge, declarative knowledge, and procedural knowledge as parts of their pedagogical knowledge of the metacognition.

Wilson and Bai (2010) confirmed that participant’s metacognitive knowledge had a significant impact on their pedagogical understanding of metacognition. Leader (2008) concluded that no significant differences were found among the types of metacognitive knowledge studied. This was supported by Chwee et al. (2010) who revealed no significant difference by educational level on all subscales except for evaluation, which is a subscale of regulation of knowledge. Emine et al. (2011) and Narang and Saini (2013) contradicted that mean significant differences were found between knowledge of cognition and regulation of cognition factors. Emine et al. (2011) further validated that knowledge of cognition scores of pre-service teachers was significantly higher than regulation of cognition scores. Narang and Saini (2013) also reported that girls had higher mean scores for the component of ‘Knowledge of Cognition’ and ‘Regulation of Cognition’ at high and low levels as compared to the
boys. Kapadia and Garg (2012) demonstrated that metacognition of students was related to teachers’ technical competencies such as communication skill, evaluation ability, classroom management, mastery over content and ability to organize information.

Male and female differed significantly in their metacognitive awareness (Sheeja & Annaraja, 2011; Kapadia & Garg, 2012; Anandaraj & Ramesh, 2014; Oz, 2014; Choudhury & Chowdhury, 2015; Das, 2017). This was contradicted that there were no significant mean differences by gender in metacognition (Suman, 2009; Chwee et al., 2010; Fazal, 2011; Omidi & Sridhar, 2012; Rani & Govil, 2013; Mai, 2015; Jaleel & Premachandran, 2016; Sonowal & Kalita, 2017; Singh, 2018).

The studies revealed that male were having higher metacognitive skills than female. (Suman, 2009; Fazal, 2011; Choudhury & Chowdhury, 2015). These findings were opposed by Sheeja and Annaraja (2011), Kapadia and Garg (2012), Anandaraj and Ramesh (2014), Oz (2014), Das (2017) and Coskun (2018) that female students were better than the male students in their metacognition.

There was significant difference in locality of students and teacher educators in their metacognition (Sheeja & Annaraja, 2011; Rani & Govil, 2013; Choudhury & Chowdhury, 2015; Das, 2017). These findings were contradicted by Anandaraj and Ramesh (2014) and Jaleel and Premachandran (2016). Urban college students and teacher educators were better than their rural counterparts in their metacognition. (Sheeja & Annaraja, 2011; Choudhury & Chowdhury, 2015; Das, 2017).

Jaleel and Premachandran (2016), Das (2017) and Sonowal and Kalita (2017) expressed that there was no significant difference in the metacognitive awareness of students based on the type of management of the school.
Young and Fry (2008) and Das (2017) reported that scores on the Metacognitive Awareness Inventory (MAI) significantly differed between graduate and undergraduate college students. Das (2017) further confirmed that Metacognitive ability of postgraduate students pursuing B.Ed. was found to be higher than the graduate students. Fazal (2011) also agreed that teachers with higher academic and professional qualifications achieved higher scores on the MAI.

Fazal (2011) demonstrated that metacognitive awareness was correlated with internet use and library habits. The results also indicated that metacognition was not a single variable but was highly multivariate. Mai (2015) expressed that no significant differences were found related to teachers' age. There was an interaction between teachers' age and educational level concerning their perception towards metacognition.

**Metacognition and Academic Achievement**

Narang and Saini (2013) reported that metacognition of boys and girls were significantly associated with academic achievement. Majority of boys and girls had high metacognition along with good academic performance.

There were significant differences between overall metacognitive awareness and their academic achievement. (Alci & Yuksel, 2012; Oz, 2014; Jayapraba, 2013; Rani & Govil, 2013; Mozafari et al., 2016). Mozafari et al. (2016) supported that the control and monitoring skill components had a significant explain for academic achievement of high schools students. The above findings were substantiated by Goudarzi and Ghonsooly (2014) that there were significant differences between the 3 groups (low, average and high) of metacognitive awareness in their effects on test performance. Learners with high metacognitive awareness performed statistically better than average and low groups. Dixit (2011) contradicted that no significant
difference was found in the readiness towards the use of metacognition of higher secondary students on the basis of their academic streams.

Narang and Saini (2013) and Oz (2014) reported that there was a strong and positive correlation between both knowledge of cognition (KOC) and regulation of cognition (ROC) as predictors of academic achievement. Narang and Saini (2013) agreed that the subjects with high level of metacognition also performed above average in academics. Oz (2014) further found that regulatory skills outweighed knowledge of cognition as a predictor of academic achievement. Procedural knowledge as well as planning emerged as a significant predictor of GPA.

There was significant relationship between metacognitive awareness and achievement. (Hrbackova et al., 2012; Young & Fry, 2008; Suman, 2009; Balya & Khimnani, 2011; Alci & Yuksel, 2012; Jayapraba, 2013; Pishghadam & Khajavy, 2013; Chowdhry, 2013; Oz, 2014; Veloo et al., 2015; Das, 2017; Sonowal & Kalita, 2017; Saeedzadeh, Raeisoon, & Mohammadi, 2018; Singh, 2018). Emine et al. (2011) also supported that academic success can be related with certain regulation skills. As the GPAs of pre-service teachers increased, their planning and monitoring awareness developed. Mozafari et al. (2016) verified that there were correlation between metacognitive skills and three of its components (planning, regulation, control and monitoring) and academic achievements.

Cetin (2017) contradicted the above findings that there was no significant correlation between metacognition and academic achievements.

Apart from the reviews related to metacognition, ICT awareness was another area of exploration and serious deliberation for the researcher.
ICT Awareness

After critical evaluation of related studies related to ICT Awareness, the researcher had made the following conclusions. The studies proved that the ICT tools and the skill of using ICT tools enriched the teaching and learning process.

The reviewed studies reported that the level of ICT awareness of teachers as well as students was very high (Akpojotor, 2016; Muhammad & Prema, 2017). Ani et al. (2016) reported that student's lack access and awareness to ICT resources and lack ICT skills. Rajasekar and Vaiyapuri (2007) and Thakur (2014) contradicted the above findings that there was a low degree of ICT awareness and computer knowledge of teachers. Rao (2008) verified that there was difference in the access and awareness of media infrastructure for students at home. Sami (2009) found that most of the users were not aware of many of the electronic information services. Non-technical users were not aware of even internet.

Beena and Mathur (2012) concluded that majority of the aided and self financing management training college students were having average knowledge about ICT. But there was no significant difference between the types of management of students in their ICT awareness in education. Sahni (2012) exhibited that most of the prospective teachers got moderate level of knowledge of computers. Akpojotor (2016) agreed that there was significant relationship between student’s level of awareness of electronic information resources and their usage of the resources.

Male students have shown better awareness and knowledge of computers as compared to female students in the use of ICT in education (Beena & Mathur, 2012; Francisca, 2012; Sinha, 2012; Sahni, 2012; Babu, 2013). The finding was contrasted by Rajasekar and Vaiyapuri (2007) and Philomina and Amutha (2016) who found that the female teachers were better than males in computer knowledge and ICT awareness.
respectively. Gulhane (2011), Thakur (2014), Amutha and Kennedy (2015) and Verma and Dahiya (2016) revealed that there was no significant difference in the level of ICT awareness among the male and female trained teachers as well as students. This was contradicted by Babu (2013), Philomena and Amutha (2016) and Muhammad and Prema (2017).

**ICT Awareness and Academic Achievement**

Khedekar and Magre (2011) reported that there was a significant difference in the level of awareness of ICT and academic performance. Also type of institution influenced the academic performance of secondary students. Kyriakides (2014) and Yemisi et al. (2014) explored that majority of student teachers used ICT to enhance their academic performance. Park et al. (2009) interpreted that the lowest achievement group showed the most significant improvement after CAI. Moreover boys tended to perform better with CAI than girls. Erdogdu and Erdogdu (2015) revealed that availability of internet connection at home or school has positive impacts on academic success. The reviewed studies reported that academic performance of students had significant relationship with internet usage as well as internet knowledge and web-based learning time (Okorie, 2010; Hanbay, 2013).

**ICT Awareness and other Variables**

The trainees significantly differed in their competencies and internet knowledge with respect to their type of institution (Francisca, 2012). Sahni (2012) also found that knowledge of computers was higher in case of prospective teachers of aided colleges than self-financing colleges. This finding was not supported by Rajasekar and Vaiyapuri (2007) who reported that there was no significant difference in computer knowledge between the Government and private schools teachers. Jattan and
Chaudhary (2015) agreed that all the students were having the knowledge of computer and internet.

Onasanya et al. (2011) confirmed that the male belong to higher computer literacy level than the female. Also there was a significant difference between male and female science teachers in their level of computer literacy and utilization of ICT’s. Sahni (2012) reported that male prospective teachers of aided colleges and self-financing colleges had more knowledge of computers than females. Also male and female prospective teachers of aided colleges had higher knowledge of computers than male and female prospective teachers of self-financing colleges.

Rajasekar and Vaiyapuri (2007) and Thakur (2014) concluded that there was significant difference in computer knowledge of teachers’ with respect to locality. Urban school teachers were better than rural teachers.

Onasanya et al. (2011) proved that the level of computer literacy and utilization of ICT resources was very low. Sami (2009) agreed that majority of non-technical staff found the use of electronic services to be difficult which was opposed by Jattan and Chaudhary (2015). Siddique and Abraham (2010) expressed that 35% teachers were willing to undergo training and use computers in classroom teaching. Thakor (2012) reported that majority of teachers were very passive towards ICT usage. Jagadesh (2017) expressed that the usage of windows office ranked the highest among the usage of ICT tools by the faculty of education in teaching learning processes.

Teachers’ ICT skills were at moderate levels, and majority of teachers were moderate users of ICT in classroom teaching. There were significant differences of teachers’ ICT skills with respect to gender, age, years of teaching experience, and type of ICT training (Alazam, Bakar, Hamzah, & Asmiran, 2012).
Apart from the reviewed studies related to metacognition and ICT awareness, academic achievement was another area of exploration and serious deliberation for the researcher.

**Academic Achievement**

After critical evaluation of related studies related to academic achievement, the researcher has made the following conclusions. The studies proved that academic achievement influenced the teaching and learning process.

The reviewed studies reported that academic performance of students had significant relationship with internet communication and effectiveness of e-content (Jebraj & Mohanasundaram, 2008). O'Brien (2011) contradicted that internet and facebook usage had no significant relationship.

The reviewed studies explored that educational aspirations influenced academic achievement of school students (Moore, 2016) which was contradicted by Mohapatra (2013). Sorour (2016) reported statistically significant relations between school achievement and school children’s gender, age, grade, father’s education, mother’s age, residence and income. There was significant difference between problem solving ability and academic achievement (Devi, 2009; Pathak and Tiwari, 2017)

The studies revealed that school environment, psychological stress, perception of classroom environment, emotional maturity, and study habits also had impact on academic achievement (Vishwakarma, 2008; Kumar & Kumar, 2011; Benipal & Singh, 2014; Lal, 2014; Chawla, 2016)

Both Benipal and Singh (2009) and Kumar (2015) reported that academic achievement improved due to intelligence. There was no significant difference
between the prospective teachers of distance mode and regular mode in accordance with their academic achievement (Jabeen, 2017).

The reviewed studies concluded that the academic achievement of the tribal students was found to be significantly lower than non-tribal students (Mohapatra, 2013; Andrabi, 2015). It was also found that there existed a positive correlation between academic achievement and self-concept (Mohapatra, 2013; Agrawal & Teotia, 2015). Further studies revealed that there existed a positive correlation between academic achievement and achievement motivation (Mohapatra, 2013; Kumar, 2015; Rather, 2016).

There was a significant influence of school type on achievement in primary schools, where private schools were having a better performance than public schools (Endeley, 2017). Alfifi and Abed (2017) reported that female perform better than male students. While, residential area of student, family size, family income and parents’ education level has no significant influence on student’s achievement.

The present study is different from the above reviewed studies in many ways. Firstly with regard to the first variable metacognition, it is different from others by its self made tool, where it focused on prospective teachers of physical science major.

Secondly, the study on ICT awareness is creatively combined with metacognition and on this ground it stands different from the rest of the studies conducted earlier.

Thirdly, with regard to the third variable academic achievement, this study is different from other studies by its dimensions. The academic achievement of prospective teachers of physical science major was measured through a self made tool on all the three core papers and one methodology paper in B.Ed. namely Education in the emerging Indian society, Psychology of learning and human development,
Educational innovations and curriculum development and Content and methods of teaching of Physical Science. In this way it is different from other studies.

Fourthly, the influence of ICT awareness on academic achievement of physical science students is also the first of its kind in this regard.

Finally, the relation among metacognition, ICT awareness and academic achievement which is revealed by the reviewed studies motivated the researcher to study the same among prospective teachers and hence this study. The present study differs from others in terms of population, sample and tools. Hence it is relevant for the researcher to study about metacognition, ICT awareness and academic achievement of prospective teachers of physical science.

The ensuing chapter deals with the methodology of the study.