CHAPTER 3
REVIEW OF RELATED LITERATURE

3.1 Literature related to Multimedia in Education

3.2 Literature related to Teaching and Learning of Solid Geometry
Introduction

Review of related literature allows the researcher to be acquainted with current knowledge in the field in which research is going to be conducted. Review of literature avoids duplication of work that has already been done and helps to go deep into the problem at hand so as to study a different side of the problem. According to Best (1995), “A brief summary of previous research and the writings of recognised experts provide evidence that the researcher is familiar with what is already known and what is still unknown and untested”.

The investigator referred Encyclopedia of Education, Educational Surveys, Journals of Education, Educational Yearbooks, Dissertations, and Research Abstracts to make a review of the literature related to the present study. This chapter of the research report deals with the review of related aspects of the strategy and the subject involved in the study. The literature reviewed is organised in two sections, viz.

3.1 Literature related to Multimedia in Education

3.2 Literature related to Teaching and Learning of Solid Geometry

The literature reviewed in each section is detailed below.

3.1 Literature related to Multimedia in Education

Some of the studies and findings related to Multimedia in Education are presented below.

Gupta and Tyagi (2014) tested the effectiveness of computer-assisted instruction on achievement in Biology among Senior Secondary School students. The result of the study revealed that post-test achievement scores of the experimental group were significantly higher than that of the control group students. So, they concluded that computer-assisted instruction is effective in enhancing the achievement of students.
Stephen, Sowmya, and Senthilkumar (2014) tested the effect of computer-assisted instructional package as a self-learning material in learning English grammar. They concluded that the package developed by them for eighth standard students is an effective and appropriate one for use as a supportive material to teach English language.

Angel and Viswanathappa (2013) investigated the impact of computer-assisted instruction on academic achievement in Mathematics. The study reveals that use of computer-assisted instruction enhances achievement in learning Mathematics. Thus mediation of information and communication technology in the teaching learning process enhances learning which in turn helps to provide quality education.

Khasnis (2013) conducted a study on enhancement of Mathematics learning through computer-assisted instruction, which showed positive outcomes in the students’ immediate achievement in Mathematics and attitude towards Mathematics. The investigator concludes that computers should be integrated into the Mathematics education system for effective learning.

Krishnan (2013) developed and tested a multimedia package for students at primary level with dyslexia. The findings revealed that the package is effective in reducing the reading miscues. Significant enhancement was seen in the reading attainment scores and reading capacity of dyslexic students after the intervention of the multimedia package.

Mehar and Kumar (2013) investigated the effect of audiovisual aids on achievement in Physics in relation to Creativity. He arrived at the conclusion that audio-visual aids were found to contribute significantly to higher achievement scores and Creativity of students. Significant interaction was also found to exist between the two variables.

Nirmavathi (2013) conducted a study to test the effectiveness of multimedia for the development of scientific attitude. The sample consisted of
Secondary School students of ninth standard. The multimedia package, prepared by researcher for teaching science, was found to be more effective than the conventional method on the scientific attitude of ninth standard students.

Tyagi (2013) developed and validated a computer-assisted instruction learning module on Biology. The study revealed that computer-assisted instruction provides greater opportunities for students to learn and is better than the traditional method of learning. It enhances achievement and is capable of providing novel multisensory learning experiences.

Abbas (2012) developed and tested a metacognition integrated science learning package for students at Secondary School level. She found that the prepared package is effective in enhancing achievement in Chemistry, meta cognitive ability, self-efficacy, scientific creativity, social skills and retention capacity as well as in reducing anxiety of secondary school students. The study implies application of modern technologies embedded with metacognition in the teaching-learning process in our classroom.

Anilakumari (2012) conducted a study on multimedia remedial tracking package for dysgraphia among primary school students with specific learning disabilities and found that the package is more effective on the performance of primary school students with specific learning disabilities having different learning styles with respect to different aspects of dysgraphia and with respect to different aspects of dysgraphia characteristics.

Tankha (2011) tested the effect of blended-learning approach on learning of Mathematics. It was found that blended-learning, which was the combination of traditional face-to-face teaching methods with authentic online learning activities, has the potential to transform student learning experiences and outcomes. The study also revealed that the approach allows for more creative and interactive course assignments.
Anboucarassy (2010) conducted a study to find out the effectiveness of multimedia approach over the conventional method in teaching Biological science among ninth standard students. The study revealed that there was a significance difference in the achievement of the experimental group over the control group. It was also found that multimedia helped the students in the experimental group to sustain their interest and also their retention power as compared to the traditional method of teaching. The investigator concluded that the multimedia approach is considered to be one of the best techniques for teaching Biology at ninth standard level.

Kumar and Habtemariam (2010) undertook a study entitled ‘Learning with Multimedia: A constructive cooperative approach in education’ and concluded that most of the multimedia programs for educational purpose create situations that enable students to interpret information for their own understanding.

Ponraj and Sivakumar (2010) conducted a study to find out the effectiveness of Computer-Assisted Instruction in teaching Zoology in relation to the learners’ personality. The sample consisted of 40 students in Control Group and 40 students in Experimental Group. The data were collected using appropriate tools and it was analysed by ‘t’ and ‘F’ test. It was concluded that the achievement scores of the students in the experimental group were higher than those of the control group students.

Rajakumaran, Soureche, Venguidaragavane, and Viswanathan (2010) in their article ‘Role of ICT in teaching and learning Mathematics’, states that information and communication technology is a very powerful resource that can bring about substantial changes in teaching and learning of subjects, especially Mathematics. They further state that this will enable the students to manipulate diagrams dynamically and encourage them to visualize the Geometry as they generate their own mental images.
Reddy, Ramar, and Ponnambalam (2009) tested the effectiveness of multimedia based modular instruction on the achievement in Science of problem students. Two matched groups of problem students were constituted for the experiment. The problem students in the Control Group were given routine treatment during the school hours. The problem students in the experimental group were subjected to multimedia based modular instructional strategy for a period of three months. The obtained results established the effectiveness of multimedia based modular instruction on the achievement in Science of the problem students.

Mohanty (2008), in his article ‘Multimedia approach to teaching’, stated that a variety of resources, starting from the traditional media to the internet, are now accessible and if multimedia is to be taken advantage of in the teaching-learning process, teachers have to use their imagination, ingenuity and initiative.

Sindhu (2008) developed an E-learning strategy for teaching Biology at Higher Secondary level. Three techniques of E-learning strategy, viz. website learning, E-mail learning and voice chatting techniques, were selected. She concluded that the strategy is highly effective for teaching Biology at higher secondary level. She also compared the performance of different intelligent groups with regard to three of the techniques of the E-learning strategy.

Nimavathi and Gnanadevan (2008) developed a multimedia programme for the teaching of Science in standard IX. They studied its effectiveness over the conventional method of teaching. The study revealed that the multimedia programme prepared by the researchers has an impact on learning of standard IX students and also in their attitude towards use of computers.

Susan (2008), in her paper ‘Multimedia packages: Relevance for effective evaluation’, explains the importance of multimedia packages in the present scenario, role of teachers in multimedia approach and evaluation of a
multimedia package. A structure of a multimedia evaluation proforma was also presented in this paper. She is of the view that the multimedia package should be evaluated in terms of the presentation of the content, teaching experiences given, language used, computer potentialities, etc.

Benjamin and Sivakumar (2007), in their article ‘Multimedia enhances effective self-learning’, emphasised the need and importance of learning by using self-learning multimedia CDs, and dwells on the quality as well as quantity of teaching and learning, bringing forth the need and significance of learning Science through self-learning with the help of CD-based Courseware.

Jyothi (2007) prepared a self-instructional module on the topic ‘Chemical Bond’ for Class 9 students of Chemistry and compared the effectiveness of the self-instructional module with conventional teaching methods. The investigator found that the self-instructional module prepared by a teacher through power-point presentation has immense positive impact on learning of Chemistry.

Anshu (2006) made a comparative study of the effectiveness of single medium and multimedia on learning gains of 9th graders in Chemistry at different levels of academic achievements and intelligence. The study revealed that multimedia is as effective as the traditional method for the teaching of Chemistry to develop the ‘knowledge’ and ‘understanding’ domains of students having different and varied abilities.

George (2006) conducted a study on the awareness and achievement of student teachers at primary level in their use of modern instructional strategies. It was found that the student teachers at primary level do not have adequate awareness about modern instructional strategies. Again, she compared cooperative learning package and computer assisted instruction software with conventional lecture method on the academic achievement of the student teachers. She concluded that the academic achievement and delayed memory
achievement of student teachers using modern instructional strategies was found to be better than that of student teachers using conventional lecture method.

Anbuchelvan and Solayan (2005) found out the effect of using audio-visual equipment on reading-writing communication among the students of standard V. The major finding of the study was that the experimental group scored significantly higher on performance in reading and writing communication than did the control group.

Blijleven (2005) carried out a study entitled ‘Multimedia cases: towards a bridge between theory and practice’. The study was conducted within the context of the Multimedia in Science and Technology Project. The project developed and investigated multimedia cases for the professional development of prospective teachers in elementary science education. They found that a multimedia case via guiding task contributes to a meaningful interaction between theory and practice.

Chou (2005), in his study ‘Designing good institutional contexts for innovation in a technology-mediated learning environment’, developed a research framework to delineate the relationships among knowledge sharing (KS), coordination and support of technology-mediated learning environment (CTML) and three antecedents of technology-mediated learning innovation (TML). Results indicate that KS has a positive influence on all the three antecedents of TML innovation, while CTML exerts a positive impact only on instructors’ ability to explore.

Devi and Kumar (2005), in their article ‘The usage of technology in Mathematics education’, states that Mathematics education demands a multimedia environment for the presentation of its ideas. Authors feel that this will facilitate better conceptual understanding of Mathematics.
Gladiz (2005) developed a computer assisted model to teach Biology at higher secondary level. The result of the study revealed that post-test achievement scores of the experimental group were significantly higher than that of the control group students. So she concluded that the model is highly effective for teaching Biology.

Sangeetha (2005) identified the impact of multimedia and co-operative learning in enhancing the writing competence of High School students. She found out the existing level of writing competence of High School students and identified the impact of multimedia and cooperative learning on it. She also compared the relative efficacy of multimedia and cooperative learning on the writing competence of students. The study revealed that both the approaches are effective in improving students’ performance, but it cannot be said that one of the two approaches is more effective. Also, small group interactions and use of multimedia enhances language learning by making it more interesting.

Casanova (2004) made an analysis of computer-mediated communication (CMC) technologies as tools to enhance learning. The findings of the study indicate that the faculty was mainly using CMC technologies to support teaching practices and to improve teacher’s productivity. Information technologies were basically targeted to increase interactivity, open avenues for feedback and provide online resources, but less used for inquiry based and active learning.

Gurvich (2004) carried out a study on the development and validation of a computer mediated simulation training application designed to enhance task modification decisions among pre-service physical education teachers. The study revealed the importance of developing the decision making skills among pre-service teachers and establish the need for further examination of these skills in teacher education programme.

Jung (2004) conducted a multivariate analysis of students’ perceptions regarding web-based multimedia materials as learning tools for human
anatomy. The study was conducted to investigate the relationship between three educational factors and to determine which sub categories among the educational factors significantly affect the learner’s perception. He concluded that the web-based multi-media materials were useful for both anatomical lab activities and knowledge construction.

Fulick (2004), in his study on knowledge building among school students working in a networked computer-supported learning environment, suggests that students employ a range of tacit tools and rules when engaging in knowledge-building and that the process of critical incidental identification and recall used in the research may be employed as a valuable pedagogical tool when online discussion is used with students.

Meza (2004) conducted a study on the use of computer technology by college bound seniors graduating from a large urban high school in a southwest border community. The purpose of the research was to describe and examine how college bound seniors use computer technology to pursue higher education. In this study, he found that the college bound seniors primarily used computer technology to prepare, select and apply for college.

Ranade (2004) tested the effectiveness and critical evaluation of a computer-assisted instructional package developed for teacher educators. The major finding was that even though information on multiple intelligences was not readily available, the content of the presentation was very useful. Besides, those teachers who were almost computer illiterate, felt motivated to learn to use computers after seeing their usefulness in teaching and learning.

Taj (2004) conducted a study on the use of activities and multimedia package in enhancing the performance and self-confidence of slow learners through activities and use of multimedia package. The subjects were exposed to the experimental program, which consisted of audios, films, visuals and computer-assisted instruction. In addition, the researcher employed activity method also. The major finding was that there was no significant difference
between the experimental and control groups with respect to self-confidence and performance in Environmental Science, indicating that the slow learners improved significantly both in terms of their achievement and self-confidence following the experimental program, thereby proving its effectiveness.

**Alexander (2003)** prepared and validated two multimedia packages in the teaching of Science for the hearing impaired students of secondary schools. The results showed that both the packages are more effective than the traditional method of teaching for the hearing impaired students of standard IX. She also compared the two packages with regard to different intelligence level of students.

**Card (2003)** carried out a study on teachers’ perception of using information and communication technology in the classroom. The investigations found that majority of teachers expressed confidence in using computers, but they were not confident enough to use them in the classroom. Feelings of vulnerability and poor understanding as to how the technology can be used in classroom account for some of this lack in confidence.

**Balasubramanian and Rangarajan (2002)** developed and validated a syllabus-oriented computer-based instructional package for teaching Physics at Higher Secondary level. The developed computer software packages proved effective in teaching Physics.

**Chapman (2003)** conducted a study on adoption of computer technology by business teacher educators. The study identified and assessed the factors that influence business teacher educators to adopt computer technology methods and utilise them in their instruction and determined the extent to which the business teacher educators are adopting computer technology in their teaching. The findings of the study revealed that a large percentage of the business teacher educators were early adopters. They always used word processing and integrated computers, projectors and e-mail in their instruction.
Smith and Krista (2002) carried out a study on the effects of online time management practices on self-regulated learning and academic self-efficacy. The study investigated the use of web-based mechanism that was designed to attempt to influence levels of self-efficacy by engaging participants in an experimental procedure. The process encouraged the participants to monitor their time management behaviours and engage in self-regulated learning process. No significant findings were discovered but many implications regarding the development and implications for future interventions are inferred.

3.2 Literature related to Teaching and Learning of Solid Geometry

Some of the studies and findings related to Teaching and Learning of Solid Geometry are presented below.

Goosen (2014) in his article ‘Learning Geometry by designing Persian mosaics’, explains about his work done to encourage students to do Geometry. The art of Islamic Geometric ornamentation was chosen as the central theme of a lesson strand which was developed using the newly presented didactical tool called ‘Learning by Acting’. The Dutch students who took these lessons in 2010 to 2013 were challenged to act as if they themselves were Persian medieval designers of geometric patterns and construct new mosaics. Their presentations proved that they were proud of their results and gained Mathematical knowledge. The teachers welcomed the new didactical approach. As a side-effect, it improves cultural awareness among students from various religious backgrounds.

Gavin, Casa, Adelson, and Firmender (2013) conducted a project on the impact of challenging Geometry and measurement units on the achievement of grade-2 Students. They developed and tested the challenging Geometry and measurement units for all K-2 students. The experimental group exhibited a deeper understanding of Geometry and measurement concepts as measured by
the open-response assessment while still performing as well on a traditional measure covering all Mathematics content.

**Giofre, Mammarella, Ronconi, and Cornoldi (2013)** conducted a study on the involvement of visual and spatial working memory (VSWM) in intuitive Geometry and in school performance in Geometry at secondary level. The study was conducted on 166 students. A complex VSWM task requiring the manipulation of visual information as well as core and culturally-meditated principles of Geometry directly predicted academic achievement in Geometry.

**Hwang and Hu (2013)** conducted a study on peer learning behaviours using multiple representations in virtual reality and their impacts on problem solving in Geometry. An Interactive Future Mathematics Classroom (IFMC) based on the collaborative virtual reality learning environment was proposed to facilitate problem solving in three-dimensional Geometry. It was found that IFMC was useful to facilitate problem solving in Geometry by sharing ideas and exploring multiple representations.

**Kesan and Caliskan (2013)** investigated the effect of learning Geometry topics of 7th grade in primary education with dynamic geometer's sketchpad Geometry software on student's success and retention. They concluded that there was a significant difference between achievement test scores of the experimental group who were exposed to dynamic Geometry software and the control group who were exposed to the traditional method, the difference was in favour of the experimental group.

**Mandaci and Kendir (2013)** tested the effect of using metacognitive strategies for solving Geometry problems on students' achievement and attitude on fifth grade students. They found that the students in the experimental group had developed a better attitude toward Geometry and Mathematics, which might be attributed to the improvement in their self-confidence. Also, these students had developed the ability to perceive the importance of problem solving, to understand problems, to be involved in planned studying, and to
Review of Related Literature

tcontrol and be aware of the problem solving process. The improvement in their attitude toward Geometry and Mathematics led to a corresponding increase in their achievement.

**Widder and Gorsky (2013)** carried out preliminary qualitative research aimed at documenting what high school students did and why, as they dealt with three dimensional Geometry problems represented by a 3D software program. It was found that students with relatively low spatial ability skills use the software's tools much more than good visualizers, primarily for making measurements. Students with relatively high spatial ability skills use the software sparingly, primarily to rotate the geometric objects.

**Baccaglini-Frank (2012)**, in his article ‘Dragging and making sense of invariants in dynamic Geometry’, presents an activity that can be used in high school Geometry that can help students develop the concepts of the premise and the conclusion of a conjecture. This open-ended activity in dynamic Geometry can allow for explorations in maintaining dragging, a specific technique that can be useful for generating conjectures. Activities such as these offer students the opportunity to use their prior Mathematical knowledge as they enhance their learning, to engage in a physical experience within a dynamic Geometry system (DGS) and to build new Mathematical knowledge actively.

**Chinnappan, Ekanayake, and Brown (2012)**, in their article ‘Knowledge use in the construction of Geometry proof by Srilankan students’, suggests that the activation and utilisation of this knowledge during the construction of proof need to be guided by general problem solving and reasoning skills.

**Guven (2012)** tested the effectiveness of Dynamic Geometry software to improve the understanding of transformation Geometry among eighth grade students. It was found that the experimental group out-performed the control
group not only in academic achievement but also in levels of learning of transformation Geometry.

Kinach (2012), in her article ‘Fostering Spatial vs. Metric Understanding in Geometry’, states that learning to reason spatially is increasingly recognised as an essential component of Geometry education. Generally taken to be the ability to represent, generate, transform, communicate, document, and reflect on visual information, ‘spatial reasoning’ uses the spatial relationships between objects to form ideas. Spatial thinking takes a variety of forms, including building and manipulating two- and three-dimensional objects; perceiving an object from different perspectives; and using diagrams, drawings, graphs, models, and other concrete means to explore, investigate, and understand abstract concepts such as algebraic formulas or models of the physical world. The article describes the three strategies, viz. experiential, inductive, and comparative, and the five learning tasks that she has found most effective for deepening the spatial aspect of students' geometric understanding.

Levav-Waynberg and Leikin (2012) conducted a study on the use of Multiple Solution Tasks for the evaluation of Students’ Problem-Solving Performance in Geometry. The study showed that the research instrument differentiates between students belonging to high- and regular-level instruction groups and sheds light on the interrelations between components of Geometry knowledge and creativity.

Mammana, Micale, and Pennisi (2012), in their article ‘Analogy and dynamic Geometry system used to introduce three-dimensional Geometry’, propose a sequence of classroom activities on Euclidian Geometry, both plane and space Geometry, to make three-dimensional Geometry more catchy and simple. The system consists of guided research activities that lead students to discover unexpected properties of two apparently distant geometrical entities: quadrilaterals and tetrahedra. The activity has been realised by means of an
efficacious conceptual tool, the analogy as well as an operative one, a dynamic geometric software.

**Miyazaki et al. (2012)** conducted a study on potentials for spatial Geometry curriculum development with three-dimensional dynamic Geometry software in lower secondary Mathematics. Six potential effects were identified through which students’ learning can be enhanced, viz. expanding the range of content in the spatial Geometry curriculum, clarifying the connection between different units of school Mathematics, strengthening the correspondence between Mathematics and the real world, making the constructing and observing activity more dynamic, making the explorative activity more productive, and making the proving activity more sophisticated. It was found that the first three are related to the Mathematical content to be learned and the latter three are related to the intended Mathematical activity.

**Moore and Linder (2012)**, in their article ‘Using Dance to Deepen Student understanding of Geometry’, presents an example of a collaborative effort between a dance specialist and four third-grade classroom teachers at an arts magnet school. They developed a Dance and Geometry integrated project including implementation strategies, assessment tools, and reflections. Assessment showed that the programme could help students in better understanding of Geometry.

**Zhang, Ding, Stegall, and Mo (2012)** tested the effect of Visual-Chunking Representation on Geometry testing for Students with Math disabilities. They found that the visual-chunking representation accommodation improved students' performance on problem solving tasks in Geometry. An interview confirmed students' preference for the visual-chunking representation approach.

**Circello and Filkins (2011)**, in their article ‘A new perspective on three-dimensional Geometry’, describes a geometric solids unit inspired by Plato's Cave Allegory that uses different forms of three-dimensional objects to
give students a clearer understanding of the realities of these objects and to improve their level of questioning and understanding.

**Clements and Sarama (2011)**, in their article ‘Early Childhood Teacher Education: The Case of Geometry’, states that for early childhood, the domain of Geometry and spatial reasoning is an important area of Mathematics learning. Unfortunately, Geometry and spatial thinking are often ignored or minimized in early education. They built a case for the importance of Geometry and spatial thinking, reviewed research on professional development for these teachers, and described a series of research and development projects based on this body of knowledge and concluded that the research-based models hold the potential to make a significant difference in the learning of young children by catalysing substantive change in the knowledge and beliefs of their teachers.

**Erbas and Yenmez (2011)** investigated the effects of using a dynamic Geometry environment (DGE) together with inquiry-based explorations on the sixth grade students' achievements in polygons and congruency and similarity of polygons. The results showed that the DGE together with open-ended explorations significantly improved students' performances in polygons and congruency and similarity of polygons. Also, students in the experimental group showed greater interest and motivation towards learning Geometry as compared to those in the control group who often showed lack of interest and curiosity. Furthermore, the students’ comments and interpretations during lessons and tests were more accurate and advanced in the experimental group as they engage more in the DGE. Moreover, qualitative data suggested that boys showed greater interest in the computer-based learning environment than girls in the experimental groups although no significant gender effect on achievement was found.

**Huang and Witz (2011)** examined the effectiveness of three instructional treatments which had different combinations of Mathematical
elements regarding two-dimensional Geometry and area measurement for developing 4th-grade children's understanding of the formulae for area measurement and their ability to solve area measurement problems. The results showed that the enriched curriculum, involving the Geometry motions and area measurement connections, effectively facilitated children's Mathematical judgments and explanations demanding high level conceptual understanding. Besides, the interview data revealed that the geometric operations of superimposition, decomposition, re-composition as well as the concept of congruence were deemed essential by children for the conceptualization of the formulae for area measurement.

**Schettino (2011),** in her article ‘Teaching Geometry through Problem-Based Learning’, describes about a problem-based approach to teaching Geometry in her classes, a transition for her and her students that inspired her to write about the differences in the methodology and classroom practice. This transition led her on a journey toward researching and learning about problem-based learning in Mathematics education at Secondary School level. Her work began to intrigue her colleagues. When the time came to change their Geometry textbook, instead of looking for a new textbook for the course, the author and her colleagues decided to create one of their own. This article discusses how one Secondary School’s Mathematics department decided to change its Geometry curriculum.

**Soucie, Radovic, Svedrec, and Kokic (2011),** in their paper ‘Teaching and Assessing Polygons Using Technology’, describe a unit on Polygons in which Dynamic Geometry Software is used for exploring and learning new concepts as well as for assessment. Through various age appropriate activities, students explore polygons and their properties, make conjectures, test them, reason about geometric ideas. They demonstrate their ability to apply their knowledge of polygons. The activities used in this model create a motivating and engaging environment where technology allows students to discover Mathematics on their own and construct their own understanding. They
emphasise the fact that studying Geometry is an integral component of learning Mathematics because it allows students to analyse and interpret the world they live in as well as equip them with tools they can apply in other areas of Mathematics. Therefore, students need to develop an understanding of geometric concepts as well as gain the adequate Geometry related skills.

Wong, Yin, Yang, and Cheng (2011) tested the use of computer-assisted multiple representations in learning Geometry proofs. The results indicated that the medium-achievement students enjoyed most while interacting with these representations and found them most helpful in learning Geometry proofs while the low-achievement students changed their attitude of hating to prove theorems in Geometry.

Bibi (2010) analysed Cognitive Tutor Curriculum which includes a representation of the learner's thinking, strategies, and misconceptions. The Cognitive Tutor Curriculum typically speeds up learning and yields greater learning as compared to the traditional Math curriculum. This research focused on the implementation of Cognitive Tutor Geometry Curriculum in eight schools in Iowa. The purpose of this study was to develop a case study evaluation of eight schools. Significant gains in student growth were observed in all the participating schools. Geometry teachers from all participating schools were interviewed for the study to gather teachers' perspectives about the curriculum. The Cognitive Tutor Geometry textbook was reviewed for coherence, focus and alignment of topics with Iowa Core Curriculum. This study presents both quantitative and qualitative analyses of the Cognitive Tutor Geometry curriculum.

Guven and Baki (2010), in their article ‘Characterising student Mathematics teacher’s levels of understanding in spherical Geometry’, presents an exploratory study that aims at the identification of students’ levels of understanding in spherical Geometry. They developed and implemented a spherical Geometry course for student Mathematics teachers. Six structured
‘task-based interviews’ were held with eight student Mathematics teachers at particular times through the course to determine the spherical Geometry learning levels. After identifying the properties of spherical Geometry levels, they developed ‘Understandings in Spherical Geometry Test’ to test whether or not the levels form a hierarchy. The outcomes supported their theoretical perspective that there are some understanding levels in spherical Geometry that progress through a hierarchical order.

**Ly and Malone (2010)** developed of an instrument to assess teachers' views on their Geometry instruction and their classroom learning environments in six government high schools in southwest Sydney. The study involved completion of a survey form using a modified and expanded ‘What Is Happening In this Class (WIHIC)’ questionnaire for teachers along with participant interviews. The findings indicated that there were positive associations between the learning environment, teachers' views on Geometry instruction and the achievement of their classroom goals.

**Pane, McCaffrey, Slaughter, Steele, and Ikemoto (2010)** conducted an experiment to evaluate the efficacy of Cognitive Tutor Geometry and found no statistically significant impact on students' attitude towards Mathematics and technology. Researchers also collected observation and interview data on teachers' instructional practices. These data suggest that many teachers had difficulty in implementing the curriculum's learner-centered pedagogy. In fact, observed levels of learner-centered practices were only modestly higher in treatment classes than in control classes.

**Duatepe-Paksu and Ubuz (2009)** investigated the effects of drama-based instruction on students' Geometry achievement, geometric thinking level, attitudes towards Mathematics and Geometry, and retention of achievement, in comparison with traditional teaching. The study revealed that drama-based instruction had a significant effect on students' achievement, retention of achievement, thinking level, and attitudes, regardless of gender, Mathematics
grade in previous year, and prior attitudes and thinking levels. Drama-based instruction made learning easy and understanding better by providing the opportunity to contextualize geometric concepts and problems. It improved attitude by getting students' attention with an exciting, motivating, and interesting learning environment.

**Hwang, Su, Huang, and Dong (2009)** conducted a study of multi-representation of Geometry problem solving with virtual manipulative and Whiteboard System. The results showed that the proposed system was perceived as useful, and helped students to understand the processes of Geometry problem solving, such as using various solving strategies, as well as exposing geometrical misconceptions. In the future, researchers also aim to apply the multi-representative construction model to knowledge construction in other domains.

**Markey (2009)** examined the relationship between visual-spatial reasoning abilities, as measured by the matrix reasoning and block design subtests of the Wechsler Intelligence Scale for Children - Fourth Edition (WISC-IV), and Geometry and Math performance, as measured by Geometry and overall Math scores from the Massachusetts Comprehensive Assessment System (MCAS). The data implicate visual-spatial ability as a factor underlying success in Math and Geometry.

**Obara (2009),** in his article ‘Where does the formula come from? students investigating total surface areas of a pyramid and cone using models and technology’, discusses the challenges pre-service secondary school teachers face in trying to understand how to work out the surface areas of square and rectangular pyramids and a cone. The pitfalls of just giving students a formula to work with without involving them in learning where the formulae come from are presented. This article presents a nice argument of how physical models and technology can come together to help students to ‘construct’ the
knowledge base that they will need to solve specific classes of problems. The article also serves as a fine example of group learning.

Pitta-Pantazi and Christou (2009) conducted a study entitled ‘Cognitive styles and Dynamic Geometry undertaken to investigate the effects on students’. The study was conducted to find out the effect of students’ cognitive styles on achievement in measurement tasks in a Dynamic Geometry learning environment, and to explore the ability of Dynamic Geometry learning in accommodating different cognitive styles and enhancing students' learning. A total of 49 sixth grade students were tested using the Verbal Imagery Cognitive Styles (VICS) and the extended Cognitive Style Analysis-Wholistic Analytic (CSA-WA) tests for cognitive styles. The same students were also administered a pre-test and a post-test involving 20 measurement tasks. All students were taught a unit of measurement (area of triangles and parallelograms) with use of Dynamic Geometry, after a pre-test. The Dynamic Geometry Software accommodated different cognitive styles and enhanced students’ learning. They concluded that verbalisers and wholist verbalisers gained more in their achievement in the environment of dynamic Geometry than students who had a tendency towards other cognitive styles. The results are discussed in terms of the nature of the measurement tasks administered to the students.

Anderson et al. (2008) investigated the relationship between three ability-based cognitive styles (viz., verbal deductive, spatial imagery, and object imagery) and performance on problems in Geometry that provided different types of clues. They found that for the problems in Geometry with either mental rotation or shape memory clues, students with a combination of both verbal and spatial cognitive styles tended to do the best. They also found that both spatial imagery and verbal deductive cognitive styles were important for solving Geometry problems, whereas object imagery was not. For girls, a spatial imagery cognitive style was advantageous for Geometry problem solving, regardless of type of clues provided.
Sekhar (2007) in his study, aimed at assessing the state of teaching Geometry in schools. He found that the teaching and learning of Geometry in Secondary Schools is poor. The investigator again concludes that the reason for the teaching and learning of Geometry in schools is due to the faulty Secondary School Certificate Examination system, where the students get ample choice that allows the students to skip learning Geometry.

George (2002) carried out a study on preparation and testing of three dimensional models for teaching Geometry at secondary level. The result of the study revealed that post-test achievement scores of the experimental group were significantly higher than that of the control group students. It was concluded that the models have proved effective in teaching Geometry.

Conclusion

The above review of related literature enabled the Investigator to gather extensive information on multimedia in education and the teaching and learning of Solid Geometry. It also capacitated the Investigator to frame the research design, to formulate the hypotheses and objectives of the study, to select the method, to develop the tools for the present investigation and to conduct the study. This review also throws light on the relevance of the present study.