CHAPTER III

REVIEW OF RELATED LITERATURE

3.1 STUDIES RELATED TO ANIMATED AND STATIC VISUALS

3.2 STUDIES RELATED TO MODERN INSTRUCTIONAL STRATEGIES
REVIEW OF RELATED LITERATURE

A careful review of the research journals, books, dissertations, theses and other sources of information on the problem to be investigated is one of the important steps in the planning of any research study (Koul, 2011). A summary of the writing of recognized authorities and of previous research provides evidence that the researcher is familiar with what is already known and what is still unknown and untested. Because effective research is based on past knowledge, this step helps to eliminate the duplication of what has been done and provides useful hypotheses and helpful suggestion for significant investigation. Citing studies that show substantial agreement and those that seem to present conflicting conclusions helps to sharpen and define understanding of existing knowledge in the problem area, provides a background for the research project, and makes the reader aware of the status of the issue (Best & Khan, 2011).

Review of the related literature not only allows the researcher to acquaint himself with current knowledge in the field but also enable him to define the limits of his field. It gives the researcher an understanding of the research methodology which refers to the way the study is to be conducted and helps him to know about the tools and instruments which proved to be useful and promising in the previous studies.
Since the present study was aimed to find out the effectiveness of Animated and Static Visuals based Instructional Strategies on Achievement in Basic Science of students at Upper Primary Level, the research studies directly or indirectly related to the area are reviewed in this chapter. After going through the profuse literature, the investigator has selected only those which are relevant to the topic under investigation, and are classified, organized and presented chronologically under the following heads.

3.1 Studies related to Animated and Static Visuals.

3.2 Studies related to Modern Instructional Strategies.

**3.1 STUDIES RELATED TO ANIMATED AND STATIC VISUALS**

Hoban & Nielson (2013) conducted a study on Learning Science through creating a “Slowmation”, in which they proposes a new way for pre-service teachers to learn science by designing and making a narrated stop-motion animation as an instructional resource to explain science concept. The finding shows that creating a slowmation (slow animation) facilitated the pre-service teachers’ learning about the life cycle of a ladybird beetle and revised their alternative conceptions.

Chen & Sun (2012) in a study assessed the Effect of different Multimedia Materials on Emotions and Learning Performance. In this study, three different multimedia materials, static text and image-based multimedia material, video-based multimedia material, and animated interactive
multimedia material, were presented to verbalizers and visualizers to investigate how different multimedia materials affect individual learning performance and emotion, identify relationships between learning performance and emotion. Experimental results show that video-based multimedia material generates the best learning performance and most positive emotion for verbalizers. Moreover, dynamic multimedia materials containing video and animation are more appropriate for visualizers than static multimedia materials containing text and image.

Chien & Chang (2012) conducted a study for the comparison of different instructional multimedia designs for improving student science-process skill learning. This study developed three forms of computer-based multimedia, including Static Graphics (SG), Simpler Learner Pacing Animation (SLPA) and Full Learner Pacing Animation (FLPA), to assist students in learning topographic measuring. The study showed that there was a significant difference with a large effect size in mental effort ratings among three groups, and the post test indicated that FLPA imposed less cognitive load on students than did SG. It also revealed that the differences of practical performance scores among groups reached a statistically significant level with a large effect size and the post-test indicated that FLPA fostered better learning outcomes than both SLPA and SG.
De Coursey (2012) published a paper on exploring the attitudes of teachers, as adult learners, towards learning to do animation. The appraisal analysis of three related surveys indicated that teachers positively realized animation as valuable, worthwhile and satisfactory, but also difficult and time consuming, and entailed high levels of communication. Quantitative data indicated their view that animation would be well-received by both colleagues and secondary language learners, as an instructional tool.

Hwang, et al. (2012) conducted a study for the review of use of animation as a supplementary learning material of Physiology content in Four Academic years. 913 students in twelve - different classes in the same physiology course learned complicated microscopic mechanisms with assistance from animations provided as supplementary materials primarily for self-study. Surveys and group interviews were conducted that provided both qualitative and quantitative feedback. Results showed that animations surely explained contents more explicitly to students (especially for the explanation of dynamic and complicated biological processes), made students more interested in the subjects taught; and there was a greater demand for similar learning tools from the students.

Koscianski, et al. (2012) conducted a study entitled ‘Short Animation Movies as Advance - Organizers in Physics Teaching: A Preliminary study. The study aimed to determine guidelines for the construction of an
instructional short animation movie, with the role of an advance organizer. A film was created in order to evaluate the effectiveness of the approach, making part of a Physics lesson and concerning the subject “moment of a force”. The study took place in a Brazilian school in the city of Arapoti. Data were collected using pre and post-tests. The findings indicated that the movie facilitated the construction of links between pre-existent knowledge and the new information presented in the lesson.

Kuhl, et al. (2012) conducted a study to investigate whether learning from dynamic and two presentation formats of static visualizations can be enhanced by means of cueing. Findings shows that for transfer tasks, learners receiving dynamic visualizations outperformed learners receiving static visualizations. A main effect in favour of cued visualizations could be observed only for pictorial tasks, but not for transfer tasks.

Lai & Newby (2012) undertook a study on the impact of static graphics, animated graphics and mental imagery on a complex learning task. This study compared the impact of different categories of graphics used within a complex learning task. One hundred and eighty five native English speaking - undergraduates participated in a task that required learning 18 Chinese radicals and their English equivalent translations. A post test only control group design compared performance differences following training, between 5 groups of participants (control, concrete verbal imagery
information, single static graphics, multiple gradient static graphics and animated graphics) on both immediate and 4 week retention tests. Data analysis indicated that all graphic groups significantly outperformed the control group, immediately following training. A 4-week delayed test showed that the group originally received multiple gradient static graphics significantly outperformed all other groups, except those received the animated graphics.

Lou, et al. (2012) undertook a study focussed to explore the effects of three different forms of the multimedia teaching materials on the achievements and attitudes of junior high school students in a chemistry laboratory context. The three forms of the multimedia teaching materials, static pictures, video and animation, were employed to teach chemistry experiments to 54 eighth-grade students in Pingtung County, Taiwan. The research tools included the self-editing questionnaire of learning achievement, the experimental step checklist, and the learning feedback questionnaire. Descriptive statistics and ANCOVA were administered to analyze the collected data. The findings of the study indicate that the video and animation have more significant effects on promoting students’ learning achievements in a chemistry laboratory context than static picture in terms of operating equipment, technical operation, experimental procedures, and observation performance.
Power (2012) in his report examines the nature of playfulness in animation and describes play as a critical tool in animation studies. Examining studio character animation from such perspectives as creative production, animated output, and audience reception, he builds on findings of animation studies, neuroscience, cognitive psychology, anthropology, semiotics, sociology and aesthetics to propose a specific or lucid mode of animation. He concludes that animation is a playground for the mind and the engagement with animated entertainment is authentic play.

Samur (2012) conducted a study to examine the effect of the redundancy principle in a multimedia presentation constructed for foreign language vocabulary learning on undergraduate students’ retention. The results revealed that adding on-screen text to a multimedia presentation with animation and narration helped students to learn new vocabulary in a previously - unfamiliar foreign language.

Schlosser, et al. (2012) in a study evaluated the effects of animation on transparency, name agreement and identification of graphic symbols for verbs and prepositions, in pre-schoolers of 3 age groups. Results of the study showed that animated symbols were more transparent than static symbols. Animated verbs were named more accurately than static verbs, but there was no difference between animated and static prepositions. Verbs were identified
more accurately compared with prepositions, but there was no difference between symbol formats.

Soemer & Schwan (2012) undertook a study entitled 'Visual mnemonics for Language Learning: Static Pictures versus Animated Morphs. In two experiments, Sino-Japanese characters and their meanings were learned with either static pictures or animated morphs as visual encoding mnemonics. The results show that both types of encoding mnemonics improved paired - associate learning compared to a non-mnemonic control group. The positive effects of encoding mnemonics remained stable over a period of one week. Experiment I showed a superiority of static pictures over animated morphs. However, this effect disappeared when the relative length of presentation time of characters and pictures in both static and animated mnemonic conditions was held constant (Experiment 2).

Unal-Colak & Ozan (2012) conducted a study on the Effects of Animated agents on students’ achievement and attitudes. The aim of the study was to analyze the effect of the use of pedagogical agents in learning materials designed in multimedia, on the achievement and attitudes of students. The research findings indicates that the use of multimedia software developed by using pedagogical agents positively affect student achievement and attitude. The achievement of the students who worked with the software significantly increased.
Wicha, et al. (2012) undertook a study entitled ‘An Animated Dictionary for Hearing - Impaired students in Thailand’ The study focussed on addressing the need to improve the teaching of English as a second language to primary school children with hearing impairments. The investigators developed an educational software tool referred to as the Total Communication with Animation Dictionary (TCAD), which supports learners in the acquisition and retention of new English lexical knowledge. The results showed that the new software tool increased learner engagement and performance compared with traditional approaches.

Yeh, et al. (2012) conducted a study for exploring the impact of prior knowledge and appropriate feedback on students’ perceived cognitive load and learning outcomes through an animation based earthquakes instruction. The aim of this study was to develop an animation - based curriculum and to evaluate the effectiveness of animation based instruction. The result of this study revealed that the students participated in the animation - based instruction outperformed the other group under study.

Zhang (2012) developed animated cartoons for Economics teaching. Some animations and cartoons were developed to explain basic economic - concepts for both macroeconomic and microeconomic issues and events. Findings of the study indicated that these resources improved learning efficiency, helped students in their understanding and long-term memory of
the subject, engaged students in their studies and increased interest in undertaking economics studies.

Aktas, et al. (2011) made an investigation on the effect of using computer animations and activities about teaching patterns in primary mathematics. The sample of their study was 28 eighth grade students of a public school in Ankara. The one group pre-test post-test design was used for collecting data. According to the findings, academic performance of the students increased by using computer animations and activities about patterns.

Barak & Dori (2011) undertook a study to evaluate the integration of web-based animated movies into primary schools science curriculum. This study aimed to examine teachers’ methods for integrating animated movies and their views about the role of animations in enhancing young students’ thinking skills and also to investigate the effect of animated movies on students’ learning outcomes. The experimental group students studied science by using animated movies and supplementary activities at least once a week. The control group students used only textbooks and still pictures for learning science. Findings indicated that animated movies support the use of diverse teaching strategies and learning methods, and can promote various thinking skills among students. Findings also indicated that animations can enhance scientific curiosity, the acquisition of scientific language and foster scientific thinking.
Barak, et al. (2011) undertook a study to investigate the effect of animated movies on students' learning outcomes and motivation to learn. Findings indicated that the use of animated movies promoted students’ explanation ability and their understanding of scientific concepts. The study also revealed that the students who studied science with the use of animated movies developed higher motivation to learn science, in terms of self efficiency, interest and enjoyment, connection to daily life and importance to their future, when compared to the control group students.

Demissie, et al. (2011) conducted a study on Pedagogy - Based - Technology and chemistry students’ performance in Higher Institutions. The study applied animation, simulation and video supporting, on student - centered learning activities, in electrochemistry and evaluated for its effectiveness. The result obtained from the experiment and responses of the schedule showed that technology integrated with appropriate pedagogy improve the performance of students.

Kayaoglu, et al. (2011) conducted a study entitled ‘A small Scale Experimental study: Using Animations to Learn Vocabulary’. In this study an attempt was made to investigate whether a difference exists between learning vocabulary via animation and via traditional paper-based method. The study was conducted at Karadeniz Technical University. The pre-intermediate classes were randomly selected as the experimental group and control group.
Results obtained from the data gathered with a pre-test and a post-test applied to each group was analyzed using 't'-test. The findings show that although there is no statistically significant difference between pre-tests of each group, there was an increase in the post-test scores of animation group as compared to the pre-test scores. This increase indicated that using multimedia such as animations contribute to students’ achievement in vocabulary learning.

Kuhl, et al. (2011) studied the effects of dynamic and static visualizations in understanding physical principles of fish locomotion. Seventy five students were assigned to one of the three conditions: a text-only, a text with dynamic visualizations, or a text with static visualization. During learning, subjects were asked to think aloud. Learning outcomes were measured by tests assessing verbal factual knowledge, pictorial recall as well as transfer. Finding showed that learners in the two visualization conditions outperformed those in the text-only condition for transfer and pictorial recall tasks, but not for verbal factual knowledge tasks.

Lin (2011) conducted a study to investigate the relative effectiveness of different types of visual (static and animated) and instructional strategies, in a computer-based instructional environment. 582 students participated in the study and they were randomly assigned to treatments and after interacting with their respective treatments, they received four individual criterion post-tests to measure achievement of different educational objectives. Findings of
the study indicated that students who received the animated visual treatment scored significantly higher on all criterion post-tests than those who received the static visual treatment.

Lin & Atkinson (2011) conducted a study to investigate the potential benefits of using animation, visual cueing and their combination in a multimedia environment designed to support learners’ acquisition and retention of scientific concepts and processes. The results of the study showed that participants provided with animations retained significantly more concepts than their peers provided with static graphics.

Miller & James (2011) conducted a study to determine whether the inclusion of basic animation techniques in power point presentations provides an additional learning aid, inhibits learning, or has no effect on student learning for students in a introductory astronomy course. The important finding are:

i. Students perceive that animated slides are substantially more effective.

ii. Student understanding as measured via in-class examinations is largely unaffected by the use of animated slides, but the end-of-semester diagnostic surveys indicate that animated presentation aid in long-term retention of the material.

iii. The animation of illustrations provide a greater impact on learning than simply the animation of text.
Nesbit & Adesope (2011) conducted a study entitled ‘Learning from Animated Concept Maps with concurrent Audio Narration. The findings of the study indicate that verbal information can be effectively communicated by learner-paced animated concept maps accompanied by audio narrations.

Ochonogor (2011) undertook a study entitled ‘Beyond the Usual Approach of Chemistry Teaching in High Schools’. The main objective of this study was to investigate beyond the usual approaches of teaching chemistry by the educators in order to determine ways and practices that can positively influence the educators’ teaching efforts and foster increased pass rate and quality of passes in Physical Sciences. The research made use of active learning model and a special form of co-operative learning strategy with extra activities including animation to teach the experimental class and compared learners’ performance with those of the control group that were taught the usual way. The study lead to the conclusion that 87% of learners in the intervention class showed remarkably improved pass rate in quantity and quality in the post-test. Also, the topics taught became more learner-friendly and the educator achieved higher confidence and proficiency in dealing with the subject.

Ozmen (2011) studied the Effect of Animation Enhanced Conceptual Change Texts on 6th grade students’ understanding of the particulate nature of matter and transformation during phase changes. A quasi-experimental
design and one control group (CG) and one experimental group (EG) were used. Results indicate that while there was no statistically significant difference between groups in pretest, performance of EG students was greater than the CG ones in post test and delayed test. Based on the study, it is concluded that the Animation Enhanced conceptual change Texts based instruction is an effective way to improve students’ understanding of basic science and chemical concepts.

Rias & Zaman (2011) reported that there was a body of evidence that supports the benefit of using technology, such as multimedia elements in the form of 2-D and 3-D animation to assist in learning. The paper discussed the applicability of some learning theories, Mayer’s cognitive theory of multimedia learning, and the use of animation in computer science education.

Seyit (2011) studied the impact of Interactive Storybook on Elementary school students Recall. The experiment utilized 77 Fourth grade students in three groups. Each student was randomly assigned with one of the three conditions: (1) Computer presentation of interactive storybooks with animation (2) Computer presentation of storybooks without animation and (3) traditional print story books. Students’ recall was measured by using multiple-choice test. The researcher used quantitative methods to analyze participants’ responses in the experiment. The results of statistical analysis indicated that the students who read the computer presentation of storybooks with animation
showed higher recall scores than those who read the computer presentation of storybooks without animation and the traditional print version of storybooks. In other words, animation used in an interactive storybook may help students’ recall better than no animation use.

Walker, et al. (2011) undertook a study to investigate the use of multimedia materials to enhance student learning in a large, introductory biology course. Two sections of this course were taught by the same instructor in the same semester. In one section, video podcasts or “vodcasts” were created which combined custom animation and video segments with music and faculty voiceover. In the other section, “class captures” were produced for each class session which combined the output of the classroom’s digital projector with a recording of the instructor’s voice. The results show that the students who used the custom vodcasts achieved significantly higher scores on an end-of-term test of evolution knowledge, than students who used the class captures.

Wang, et al. (2011) conducted a study on the Impact of Animation Interactivity on Novices’ Learning of Introductory Statistics. The study was guided by three main questions: 1) Is there any difference in achievement improvement among students who use different interactive levels of an animation programme? 2) Is there any difference in confidence improvement among students who use different interactive levels of an animation programme?
programme? 3) Is there any difference in programme perception among students who use different interactive levels of an animation programme?

This study was a one-way design where the independent variable was animation interactivity. In addition to a control group, which was provided with only static materials, there were three groups with different levels of animation interactivity. The major findings were:

i. Animation interactivity imparted student improvement on understanding and lower-level applying.

ii. Animation interactivity did not significantly impact student confidence and programme perception.

iii. Students’ lack of cognitive skills and the time limit might decrease the effect of the interactive-animation.

Yang, et al. (2011) undertook a study on Testing the Improvement of English as a Foreign Language Instruction among Chinese college students through computerized Graphic Visuals. The purpose of this study was to determine if animated illustrations would increase the recall and comprehension of a subject matter, English as a foreign language, among Chinese college students. The study was specifically designed to identify the influence of graphics on learning by comparing abstract versus concrete graphics and static versus animated graphics on immediate and long-term retention of a lesson through computer-based instruction. The results of the
study revealed significant difference in performance between the treatment
groups, indicating that concrete animation had the biggest effects on the
successful performance of the students.

Adegoke (2010) in his study examined the effect of multimedia
instruction on students' learning outcomes in secondary school physics. There
were three experimental groups and a conventional lecture method group
served as control. Data were analyzed using Multivariate Analysis of
Covariance (MANCOVA). Results showed that students in the animation plus
narration plus on-screen text group had highest post mean scores in physics
achievement test and in physics interest inventory. Students who learnt
physics in computer-based multimedia environment had better learning
outcomes in physics than the colleagues who learnt physics under teacher-
based environment.

Ali & Zamzuri (2010) conducted a study to find out the effectiveness
of teacher controlled segmented - animation presentation on learning
achievement of students with lower level of prior knowledge. Segmented -
animation and continuous-animation courseware showing cellular signal
transmission process were developed for the research purpose. Pre-test and
post-test quasi-experimental design was employed involving a research
sample consisting of 124 Diploma in Education students. Data were analyzed
by using ‘t’ test and univariate ANOVA. The results shows that teacher
controlled segmented - animation which was presented via LCD projector was significantly more effective than teacher controlled continuous- animation presentation in enhancing students’ learning performance.

Chang, et al. (2010) conducted a study to investigate whether the understanding of the particulate nature of matter by students was improved by allowing them to design an evaluate molecular animations of chemical phenomena. The results indicate that designing animations coupled with peer evaluation is effective at improving student learning with instructional animation.

de Knonig, et al. (2010) undertook a study to investigate whether learners construct more accurate mental representations from animations when instructional explanations are provided via narration than when learners attempt to infer functional relations from the animation through self - explaining. Findings indicated that cued animations were more effective than uncued animations. Results on retention and transfer indicated no differences between self-explaining and providing instructional explanations, but instructional explanations accompanying animations led to higher inference scores.

Doymus, et al. (2010) conducted a study on the effects of Jigsaw and Animation techniques on students’ understanding of concepts and subjects in electrochemistry. The study investigated the effect of jigsaw cooperative
learning and animation versus traditional teaching methods on students understanding of electrochemistry in a first year general chemistry course. This study was carried out in three different classes in the department of primary science education. The first class was randomly assigned as the jigsaw group, the second as the animation group, and the third as the control group. For students in the animation group, their lessons focussed on explaining the step-by-step process of electrochemistry through a computer-animated presentation. The main data collection tools were the Test of Scientific Reasoning and Particulate Nature of Matter Evaluation Test. The result indicated that the jigsaw and animation groups achieved better results than the control group.

Gregorius, et al. (2010) conducted a study entitled ‘Can Animations Effectively Substitute for Traditional Teaching Methods?’ Two animations, one focussed on the macroscopic phenomena and particulate conception of the three states of matter and the effects of heat on these states, and the other on solution formation and solubility were produced. The first was designed for and tested on elementary school students and the second was tested on secondary school students. A pre and post-test study was used to compare the learning gains of the students who received the animations with those who received text book reading time and discussion in class. The findings indicated that while both groups showed learning gains regardless of the
provided mode of instruction, those who received the animations obtained higher scores than the control group.

Gregorius, et al. (2010) developed animations and tested on elementary and secondary chemistry students. A pre and post-test study was used to compare the learning gains of students who received the animations with those who received textbook reading time and discussion in class. The control and experimental groups were further divided between students who have low base knowledge and those with higher base knowledge, by comparing students above and below the median on their pre-test. Findings of the study showed that students with low base knowledge and who were given the animation treatment performed at the level of high base knowledge learners.

Huk, et al. (2010) conducted a study on the educational value of visual cues and 3D representational format in a computer animation under restricted and realistic conditions. In both experiments, the educational value of 3D versus 2D animations as well as of visual cues was investigated in a $2 \times 2$ factorial design. Findings of the study showed that students’ understanding was facilitated by the presence of a 3D-representation format under tightly controlled conditions only. Regarding the ecologically more valid classroom setting, the 2D format tended to foster understanding more efficiently than the 3D format.
Kohnle, et al. (2010) conducted a study for developing and evaluating animations for teaching quantum mechanics concepts. The study aimed to investigate the educational effectiveness of animations, both in terms of student attitude and performance. A diagnostic survey administered to level 2 and 3 students showed that level 2 students significantly outperformed level 3 students on topics which they had investigated using animations.

Kombartzky, et al. (2010) proposed a strategy for learning from animations. Two different experimental studies were conducted in order to evaluate the strategy. Results of both experiments revealed that the students who were encouraged to take advantage of the strategy learned significantly more than the students who were not asked to do so.

Lin & Dwyer (2010) investigated the effectiveness of three different levels of enhancement strategies utilized to facilitate students’ learning from static and animated visualisation when taking the time-on-task into consideration. Participants were randomly assigned to six treatment groups, and then took four criterion measures. The time-on-task was measured and used as a covariate in the analysis. Findings showed that animation is more effective than static visuals for improving learning across all levels of learning.

Meyer, et al. (2010) conducted a study to investigate the effects of high and low presentation speed of animation. Results indicated that high
presentation speeds facilitated the effective learning of macro events, whereas low speeds facilitated the learning of micro events.

Paik (2010) conducted a study on Learning with Animation and the illusion of understanding. In this study a controlled experiment was conducted on the effects of two types of animation - motion and highlighting - on learning. The treatment consisted of a 3.5 minute multimedia presentation, that described the working of a flushing toilet tank. A $2 \times 2$ factorial design was employed with two dependent measures of learning (retention and transfer). Participants consisted of 65 undergraduates. The finding shows that the highlighting animation had a positive effect on both retention and transfer while motion animation had a negative effect on transfer. No significant interaction was detected between motion and highlighting was effective only when paired with lessons containing animated graphics.

Robertz, et al. (2010) conducted a study entitled ‘Learning from Animation enabled by collaboration’. The study was experimental and involved three between - subjects factors: the type of multimedia instruction (with static or animated graphics), the presence of snapshots of critical steps of the system (with or without snapshots) and the learning setting (individual or collaborative). The findings indicate that animation was overall beneficial to retention, while for transfer, only learners studying collaboratively benefited from animated over static graphics.
Rundgren & Tibell (2010) conducted a study to investigate how upper secondary and tertiary students interpret visualizations of transport through the cell membrane in the form of a still image and an animation. The results of this study support the use of multiple representations to achieve different learning goals.

Sanchez & Wiley (2010) undertook a study entitled ‘Sex Differences in Science Learning: Closing the Gap through Animation’. In this study males and females read a scientific text about plate tectonics that contained static illustrations, animated versions of the static illustrations, or no illustrations. Participants were assigned on their visuospatial ability and also working memory capacity. Findings of the study showed that while males outperformed females as both the visuospatial measure and overall science learning, the presence of animations effectively eliminated performance differences for this science topic.

Scheiter, et al. (2010) conducted a study on the acquisition of problem-solving skills in mathematics. An experiment was conducted, with 32 pupils from a German high school studied either only text-based worked examples explaining different problem categories form the domain of algebra or worked examples augmented with hybrid animations. Learners with hybrid animations showed superior problem-solving performance for problems of different transfer distance relative to those in the text only condition.
Wu, et al. (2010) conducted a study for the comparison of Earth Science Achievement between Animation-based and Graphic-based testing designs. This study developed two testing devices, namely the animation-based test and the graphic based test in the area of earth sciences. The result of this study indicated that animation-based test was a valid and reliable way of testing. While no significant difference was found between the test formats in student achievement in general, practical significance existed when the study further compared the impact of animation-based test versus graphic-based test in student achievements with various levels of prior knowledge. It was found that low prior knowledge students performed better in animation-based test while high prior knowledge students performed better in graphic-based test.

Yarden & Yarden (2010) undertook a study on Learning Using Dynamic and Static Visualizations. The study examined the unique contribution of an animation of the polymerase chain reaction (PCR) in promoting conceptual learning of the biotechnological method among 12th grade biology students. All of the students learned about the PCR using still images or the animation. A significant advantage to the animation treatment was identified following learning. Through analyzing students’ discourse, using the framework of the conceptual status analysis, it was found that students who learned about PCR using still images faced difficulties in understanding some mechanistic aspects of the method. On the other hand,
using the animation gave the students an advantage in understanding those aspects.

Aldahmash & Abraham (2009) conducted a study to compare the influence of animated visuals with static visuals on college students’ understanding of organic reaction mechanisms in chemistry. The finding revealed that the students using animated visuals performed significantly better than students using static visuals, who in turn performed significantly better than a control group with respect to knowledge of organic reaction mechanisms.

Arguel & Jamet (2009) conducted a study on the impact of presenting together both a video recording and a series of static pictures. In experiment I, 3 conditions were compared: video shown alone, static pictures displayed alone and video plus static pictures. On average the best learning scores were found for the video plus static pictures condition. Experiment 2 investigated how best to present the static pictures, by examining the number of pictures required and their appearance type (static versus dynamic). Findings revealed that dynamic presentation of pictures was superior to the static pictures mode; and showing fewer pictures was more beneficial.

Boucheix & Schneider (2009) undertook a study to investigate how learners comprehend the functioning of a three pulley system from a presentation on a computer screen. The experiment tested the effect of static
versus animated presentations on comprehension. Findings of the study indicated that an animation as well as integrated sequential static frames enhanced comprehension.

Dalacosta, et al. (2009) conducted a study on multimedia application with animated cartoons for teaching science in elementary education. The study was carried out in various elementary schools of Athens, Greece, and 179 pupils aged 10-11 years participated in it. The research results provide evidence that the use of animated cartoons significantly increases the young students’ knowledge and understanding of specific science concepts, which are normally difficult to comprehend and often cause misconceptions to them.

Korakakis, et al. (2009) conducted a study aimed to determine whether the use of specific type visualisation (3D illustration, 3D animation and interactive 3D animation) combined with narration and text, contributes to the learning process of 13 and 14 years old students in science courses. The study was carried out with 212, 8th grade students in Greece. The findings showed that multimedia applications with interactive 3D animations as well as with 3D animations increased the interest of students and made the material more appealing to them.

Rosen (2009) conducted a study on the effects of an animation-based on-line learning environment on transfer of knowledge and on motivation for Science and Technology learning. 418 5th and 7th grade students across Israel
participated in the study. Students in the experimental group participated at least once a week in science and technology lessons that integrated the animation environment. The finding showed a significant impact of animation-based on-line learning environment on transfer of knowledge and on learning motivation. Additionally, the findings showed that students changed their perception of science and technology learning as a result of teaching and learning with integrated animations.

She & Chen (2009) in their study examined how middle school students constructed their understanding of the mitosis and meiosis processes at a molecular level through multimedia learning materials presented in different interaction and sensory modality modes. Results of the study showed that the group that received animation with narration allocated a greater amount of visual attention than the group that received animation with on-screen text.

Tannu (2009) conducted a study to find out the effectiveness and agreeability of computer animation as self-learning material among the school students in India for learning science. Twenty four students from class XI, science, randomly selected and tested by pre-post tests. Paired ‘t’ test was used to find out its effectiveness. The findings showed that computer based animation was significantly proved as an effective self-learning material for learning science.
Akpinar & Ergin (2008) conducted a study to investigate the effects of instruction including interactive computer animation accompanied by teacher and student-prepared concept maps on primary students’ biology achievement, as well as revealing attitude towards science as a school subject. A quasi-experimental pre-test/post-test design was used in the study. The experimental group received instruction including interactive computer animation accompanied by teacher and student-prepared concept maps, while the control group received traditional instruction. Findings showed that the experimental group had significantly higher scores than the control group in the biology achievement test. Regarding students attitude towards science, there was no significant difference between the groups in the pre and post-test results.

Kablan & Erden (2008) conducted a study on the Instructional efficiency of integrated and separated text with animated presentations in computer-based science instruction. The results of the study showed that processing integrated text and animation format in computer-based science instruction requires less mental effort than the separated format, and that the performance of the students in the group with integrated presentation format group was higher than that of students in the group with separated presentation format. Instructional efficiency of the integrated presentation group was found to be higher than that of the separated presentation group.
Kalyuga (2008) made an investigation on the relationship between instructional effectiveness of animated versus static diagrams and levels of learner expertise in the task domain of transforming graphs of simple linear and quadratic functions. The levels of learner expertise in this study were measured using an online rapid diagnostic method, a rapid verification technique, that involves presenting learners with a series of possible solution steps reflecting various stages of the solution procedure and asking them to rapidly verify the suggested steps. The results of the study indicated a significant interaction between levels of learner expertise and instructional formats. Novice learners benefited more from static diagrams than from animated diagrams, while more knowledgeable learners benefited more from animated rather than static diagrams.

Marbach-Ad, et al. (2008) undertook a study to determine whether the use of computer animation and illustration activities in high school can contribute to student achievement in molecular genetics. The control group was taught in the traditional lecture format, whereas the experimental groups received instructions that integrated a computer animation or illustration activities. Findings of the study showed that the students who participated in the experimental groups improved their knowledge in molecular genetics compared with the control group. However, the open-ended questions revealed that the computer animation activity was significantly more effective than the illustration activity.
Moremoholo (2008) conducted a study to determine whether the animation of a linear process, requiring explanatory text, can assist students to form a better understanding of the text. 61 students participated in a pre-test post-test experimental study during which they were exposed to 4 treatment variables: text, video and text, illustration and text, and animation and text. The results indicated that no significant differences in achievements existed among the treatment groups.

Rotbain, et al. (2008) developed an activity booklet that helps students to work interactively with a computer animation which deals with abstract concepts and processes in molecular biology. The achievement of the experimental group were compared with those of a control group by means of a written questionnaire, which the students received right after the instruction. Findings of the study showed that the mean score of the experimental group was significantly higher than the mean score of the control group.

Taylor, et al. (2007) in a study examined the potential use of animation as an aid for the teaching of mathematical concepts at undergraduate level. An experiment was conducted with a group of UK undergraduate computing students to ascertain if and how animation can potentially be used to support the teaching of mathematical concepts in areas such as rotational symmetry and matrices. Results of the study indicated that animated learning materials were more useful than static representation for trading such topics.
Kelly & Jones (2007) undertook a study to investigate how the features of two different styles of molecular-level animation affected students’ explanations of how sodium chloride dissolves in water. Before and after viewing each animation the participants provided pictorial, written and oral explanations of the process at the microscopic and molecular levels. Analysis of the data showed that students incorporated some of the microscopic structural and functional features from the animations into their explanations. However, oral explanations revealed that in many cases, participants who drew or wrote correct explanations did not comprehend their meanings.

Kim, et al. (2007) conducted a study on the effect of animation on comprehension and interest. In the study, fourth and sixth grade students learned the operation of a bicycle pump from graphics that were: (i) presented simultaneously (ii) presented successively (iii) self paced or (iv) animated. The presentation mode affected evaluation of perceived comprehensibility, interestingness, enjoyment and motivation, but not comprehension test score. Fourth graders who were low in need for cognition rated the animations as more enjoyable and motivating, whereas sixth graders rated self-paced graphics as more interesting and motivating.

O’Day (2007) conducted a study on the value of animations in Biology teaching. In this study, involving 393 students, three different animations and two graphics - one with and one lacking a legend - were used
to determine the long-term retention of information. Findings show that students retain more information 3 weeks after viewing an animation without narration compared with an equivalent graphic, whether or not that graphic had a legend.

Dwyer & Dwyer (2006) studied the effect of cognitive load and animation on student achievement. In the study, systematically designed content, four individual criterion measures assessing different kinds of learning outcomes, and a variety of animation and animation enhancement strategies were employed in five independent studies involving 781 students. Results have significant implications for the use of animation in facilitating knowledge acquisition.

Lin, et al. (2006) undertook a study to compare the effects of using static visual versus computer generated animation to enhance learners’ comprehension and retention of a content-based lesson in computer-based learning environment for learning English as a foreign language (EFL). 58 students from two EFL reading sections were randomly assigned to one of two computer based instructional modules developed for the study. Once having interacted with their respective instructional materials, students took four criterion tests both immediately afterward and again four weeks later. The results showed that the animation group outperformed the static visual group in only one of the four tests, consistent for both the immediate and
delayed post-tests, indicating comparatively less positive effect from animation use.

Zhu & Grabowski (2006) conducted a study to compare the instructional effects of two web-based animation strategies against static graphics by high and low prior knowledge participants. Two-way multiple analysis of variance (MANOVA) was used to analyze the data. Important findings included equivalent, non-significant differences in performance between high and low prior knowledge participants.

Iskander & Curtis (2005) conducted a study to investigate the effects of two computer-implemented techniques on learning 3D vectors. The participants were 43 female Saudi Arabian high school students. The students were divided into four groups. Each group was allocated to a different version of software for learning 3D vectors. The versions differed in their use of colour/greyscale and static images/interactive animation. Results of the post-test showed that all students improved their overall test scores, with no significant difference between the groups. However, test scores on the visualization questions differed noticeably, with the groups viewing animated versions scoring higher than the groups seeing static versions.

Mayer, et al. (2005) conducted four experiments in which students received a lesson consisting of computer-based animation and narration or a lesson consisting of paper-based static diagrams and text. The lesson used the
same words and graphics in the paper-based and computer-based versions to explain the process of lighting formation (Experiment 1), how a toilet tank works (Experiment 2), how ocean waves work (Experiment 3) and how a car’s breaking system works (Experiment 4). On subsequent retention and transfer tests, the paper group performed significantly better than the computer group on 4 of 8 comparisons, and there was no significant difference on the rest.

Velazquez-Marcano, et al. (2004) conducted a study on the use of video demonstration and particulate animation in general chemistry. In this study, general chemistry students viewed three experiments involving dynamic fluid equilibrium in a graphic design, a video demonstration, and a molecular animation. The study investigated whether video demonstrations or particulate animations helped the students' conceptual understanding, and if the order of visualizations (video or animation first) produced any differences. Results showed that students showed improvement after each visualization and there was significant improvement in responses between the first and second visualization.

Lea Sing & Miles (1999) in a study examined the relative effectiveness on student achievement of three forms of computer presentation: digital video with text, audio only with text and static visuals with text. Results with 45 undergraduates show no significant difference in achievements, but
significant differences in the time it took participants to complete the presentations.

Chan Lin & Chan (1996) conducted a study to explore the instructional impact of using computer multimedia to integrate metaphorical verbal information into graphical representations of biotechnology concepts. In this study, six versions of instructional materials were developed: non-graphics without metaphors (control group), static graphics without metaphors, animated graphics without metaphors, non-graphics with metaphors, static graphics with metaphors and animated graphics with metaphors. Quantitative results suggested that animated graphics plus metaphorical treatment enhanced motivation the most, although metaphorical treatment seemed to be received positively regardless of what accompanied it.

Almulla (1995) conducted a study on the influence of Computer Animation on learning. This study was aimed to compare the effectiveness of animated visual graphics and non-animated visual graphics. The study showed that the dynamic group had higher achievement scores than the static group.

Rieber (1990) conducted a study entitled 'The effects of animated presentations and practice', in a computer- based science lesson involving fourth and fifth-grade students. Three levels of visual elaboration (static graphics, animated graphics, and no graphics) were crossed with three levels
of practice (behavioural, cognitive and no practice). From the findings it was concluded that Animated graphics were superior to Static graphics and no graphics so long as practice was provided. Behavioural practice was effective only when paired with lessons containing Animated graphics.

Angert & Clark (1982) used a meta-analysis procedure to review research on pictorial effectiveness which focussed on the use of static iconic visuals in instructional materials. Results showed that illustrated treatments were more effective than verbal treatments, illustrations were most effective with secondary students, and externally paced illustrations were more effective than internally paced illustrations; color illustrations were more effective than black and white.

### 3.2 STUDIES RELATED TO MODERN INSTRUCTIONAL STRATEGIES

Chundang, et al. (2012) conducted a study aimed to investigate students’ learning outcomes in classes in which the Interactive CAI (Computer Assisted Instruction) - based materials were implemented. The study revealed that, after the scores from the pre-test and post-test were compared, the students got better scores in the post-test, with statistical significance of 0.05. This implies that the CAI - based materials lead to the students’ better learning outcomes.

Cook (2012) reported that teachers need to make informed decisions about what visuals they use in their instruction. In addition, they must also
consider how they will present visuals and how diverse learners might interpret them. This article provides seven suggestions for helping students get most out of visuals presented in the science classroom: (1) Include verbal information with visuals (2) Integrate verbal and visual information in time and space (3) Use narration over text when appropriate (4) Be careful when providing redundant information (5) Use animations wisely (6) Keep it simple and (7) Provide guidance.

Courts & Tucker (2012) made a review of the multimedia applications, which are inexpensive, easy to implement and require limited technology skills. Multimedia items that can be easily implemented in the college classroom include animation, slide shows, blogging, instant messaging, podcasting, and video on demand. Multimedia, which uses the internet as its transfer mechanism, can be an effective method of creating a dynamic college classroom experience.

Kwon (2012) reported that computer and video games have much in common with the strategies used in special education. Free resources for game development are becoming more widely available, so lay computer users such as teachers and other practitioners, now have the capacity to develop games using a low budget and a little self-teaching. This article provides a guideline for teachers, clinician, practitioner and parent-developers
on the development of a game for the education or training of students with disabilities.

Lin & Tseng (2012) conducted a study with an intention to investigate whether videos, compared with pictures, better assist English learners to learn difficult words. It adopted a three-group immediate post test and delayed post test quasi experimental design. Ten target words were selected and embedded in a reading text, each of which was annotated by three annotation types: text only, text and picture and text and video. Three intact classes, a total of 88 students, were selected from a junior high school in northern Taiwan, each of them was randomly assigned to one of the three groups. The results revealed significant differences between the three groups, in which the video group outperformed the other two groups.

Lwo & Lin (2012) conducted a study on the Effects of captions in Teenagers' Multimedia L2 Learning. This study aimed to explore the impact of different captions on second language (L2) learning in a computer-assisted multimedia context. A quasi-experimental design was adopted, and a total of thirty two eighth graders selected from a junior high school joined the study. The results showed that the students relied on graphics and animation as an important tool for understanding English sentences.

Madanakumar (2012) conducted a study on the effectiveness of electronic media based instructional strategy to create environmental
awareness. The results indicated that electronic media based instructional strategy was more effective than the activity oriented method on the total environmental awareness, environmental theory awareness and environmental application awareness of secondary school students.

Oh, et al. (2012) conducted a study for evaluating an instructional programme using four simulation applets to facilitate understanding of gas and liquid pressure concepts among twenty two students in a year 9 class from an independent secondary school in Singapore. A comparison group consisting of twenty two students was taught using traditional didactic, chalk-and-talk instruction. Administration of a gas and liquid pressure conceptual test in a pre-test – post-test design indicated significant improvement in understanding using the simulation applets compared to the didactic instruction.

Sindhu (2008) conducted a study for developing an e-learning strategy for teaching biology at higher secondary level and found that website learning is more effective than the activity oriented method.

Meenu (2006) conducted a survey on the facilities of Educational Television programme at primary school level. Findings of the study revealed that the ETV lessons in mathematics and environmental science taught to students of both III and V standard significantly improved their achievement
in the concerned subjects, as compared to their counterparts taught through conventional method.

Darshana (2005) undertook a study entitled 'Techno-pedagogic analysis of ETV programmes and their effectiveness in terms of achievements with and without discussing and perception of students and teachers'. The programmes were largely found effective techno-pedagogically in terms of mediagenicity, audio-visual compatibility, contiguity between text and animation and between audio and visuals, media language proficiency, use of technological aids, correspondence among communication elements, and view composition. There was significant difference between the mean gain scores of control and experimental groups in all the 6 programmes.

Hiralkumar (2005) conducted a study on the effectiveness of CAI in Sanskrit for standard VIII students. The study was aimed to develop CAI in Sanskrit for standard VII students and to study its effectiveness in terms of mean achievement of students in Sanskrit and to study the reactions of the students regarding the effectiveness of the developed CAI package. The results indicated that the package was found effective in teaching Sanskrit and the reactions of the students were found positive.

Beena (2004) made a comparative study on the efficacy of teaching through the traditional method and multimedia approach in the subject of Home Science. Findings revealed that the mean achievement of the
experimental group was found significantly higher than that of the control group. From post-test to retention test almost equal reduction in performance was found in both the groups. The students were found to have favourable opinion towards the multimedia approach.

Balasubramanian & Rangaraj (2002) undertook a study on the relative effectiveness of different models of computer-based instruction in teaching Biology. The study was aimed to find out whether there is any significant difference among different modes of computer-assisted instructional strategies viz. Tutorial, Drill and Practice and Simulation in realizing the instructional objectives in Biology at Standard XI. Research findings indicated that (i) drill and practice mode was more effective when compared to the CAI in tutorial mode (ii) CAI in simulation mode was more effective when compared to CAI in tutorial mode (iii) CAI in drill and practice mode was more effective when compared to the CAI in simulation mode.

Mahesh (2001) conducted a study on the effectiveness of Instructional Strategies in General Science and Social Studies of Standard X of the National Open School. The results indicated that the instructional strategy using video lesson has been found more effective than printed lesson and post-video instructional discussion has been found more effective than video lesson.
Natesan (2001) conducted a study on the effectiveness of Teaching concepts in Mathematics through Video Cassettes. Results showed an increased level of academic achievement of the experimental group.

Maya (1999) conducted a study to test the effectiveness of computer assisted lesson in Biology for standard VIII. The major findings of the study showed that Computer Assisted Instruction was significantly superior to lecture method in terms of achievement and in realizing educational outcomes categorized under cognitive, affective and psychomotor and social aspects.

Mohan (1999) undertook a study to find out the effectiveness of computer assisted learning, self study approach and teacher centered approach in the learning of chemistry in standard IX. The study found that CAI was more effective than modular learning method and conventional method. It is also found that CAI is more effective than modular learning method for the high and average intelligence group of students.

Bhangoo & Sidhu (1998) conducted a study on the impact of selected audio-visual aids on food hygiene knowledge of secondary school students. Findings showed that students taught with audio-visual materials performed better than the control group.

Das (1998) studied the effectiveness of computer assisted learning material on learning Rhymes. Findings of the study indicated that computer assisted learning material was more effective to learn Rhymes in different
modes. The study revealed that composite mode of presentation may not ensure higher cognitive language learning.

Ilangovan (1998) undertook a study on the effectiveness of audio-video interaction in developing listening comprehension in English. The groups under study were subjected to any one of the treatment conditions namely conventional teaching method, media-based non-interactive group teaching or AV presentation as support system. Results showed that media based non-interactive group teaching was more effective in comparison to conventional teaching method. It was also found that AV presentation on support system was more effective in enhancing retention of listening comprehension.

Marthandavarma (1998) conducted a study on the effectiveness of instructional media in the prevention and control of AIDS. The results showed that the instructional media package in video lessons was more effective as compared with the lecture method in modifying cognitive and affective behavior in the prevention of AIDS.

Neera & Chetan (1998) compared the effectiveness of video teaching - learning material, video aided instruction and conventional teaching method. The findings indicated that students most favourably disposed towards Video Teaching-Learning Materials.

Weinraub (1998) while studying student learning and performance perceptions on multimedia teaching presentation, found that student
perception and attention spans during lectures were all significantly improved when the multimedia presentation was utilized. The study also found a positive effect on students' perceptions of the instructor's ability to teach the materials.

Reddy & Ramar (1997) conducted a study and the obtained results showed that the multimedia instructional strategy was more effective than traditional lecture method in teaching science and it enabled the slow-learners to cope with normal students to a considerable extent.

Chandra & Pandya (1996) undertook a study on the effect of video films for imparting legal education. Their study showed that students of science stream achieved higher than students from the art stream. In addition, students who has studied in English medium school did better than who studied in vernacular school.

Wells, et al. (1996) presented a report in the proceedings of the Mid-South Instructional Technology Conference, stated that if Multimedia Technology is to be successfully employed to enhance classroom instruction and learning, the full capabilities of the technology must be used, which includes high quality graphics and images, sophisticated navigational techniques and transitional effects, appropriate music and sound, animation, 3-D modeling and virtual reality.
Kothari & Chowdhari (1995) investigated on the impact of Television programmes on the behaviour of students of different levels, and found that girls had more positive effect on their emotional and creative behaviors than boys. With regard to the impact of Television programmes on moral behaviour, negative effects were noticed more than the positive ones.

Christeena (1994) developed and demonstrated a system for assessing the normative or expected progress of pupils, who are engaged in learning through CAI. The students' rate of progress was collected in computer generated ‘snapshots’ or training of the time elapsed between screens in a computer activity.

Purushothaman & Stella (1994) conducted a study on the effectiveness of teacher controlled interactive video for group instruction and the findings revealed a better academic achievement as compared to the traditional method.

Kapadia's (1992) work was related to the impact of TV on student learning. The study reported that the TV group gained significantly more than the control group. Even retention scores of the experimental group were better. Seventy percent of the students opinioned that TV programmes helped them in self-learning.

Rose (1992) prepared a software for CAI. This was used along with and without a trainer support system for teaching underachievers. The result
was positive. However, CAI used in conjunction with the trainer support system proved to be beneficial to the under-achievers.

Viney (1992) conducted a study on the effectiveness of different models of teaching with regards to achievement in mathematical concepts and attitude in relation to intelligence and cognitive style. Findings indicated that the Computer Model of teaching was found to be superior to the Concept Attainment Model for teaching concepts in mathematics and for inculcating positive attitude.

Idayavani (1991) developed two video programmes, one based on the concept of weathering and the other on rivers. Finding of his study revealed that the students who were exposed to the video method performed better than students taught by the traditional lecture method.

Jayamani (1991) developed a Computer Assisted Instruction package in physics for class XII students. The experimental group received CAI and after the experiment it was found that experimental group performed better on the post-test than the control group.

Kalimuthu (1991) conducted a study for developing a video programme on environmental pollution. The study concluded that the group receiving instruction through video programme learned more concepts - when compared to the group which learned through conventional method.
Mahapatra (1991) carried out a study on the topic ‘Development and effectiveness of computer aided instruction in terms of achievement and abstract reasoning of class IX students. The study found that, the CAI proved quite effective and the students’ reaction towards CAI material were positive.

Sharma (1991) compared the effect of various modes of classroom teaching involving video-based instruction, teacher discussion, demonstration, self-experimentation etc. on the achievement in science of the secondary level learners. The conclusions drawn favoured most the video based instruction, while self-experimentation under the guidance of the teacher was found to be least effective of all the models.

Sinnathambi (1991) developed a video programme on ‘energetics in chemistry’ for higher secondary students and found that the experimental group learnt more concepts and gained more on achievement test in energetics.

Aluralram (1990) made an evaluation of the UGC Programme - Country-wide Class Room Education TV Programmes. The study showed that most of the programmes cater to the urban audiences. The needs of the rural students still remain unfulfilled. The study also revealed that programmes in humanities were poor in offering knowledge enrichment.

Usha (1990) developed self instructional film strips on the topic ‘nutrition’ and found that students who studied with the help of this film strips
got higher scores when compared to the control group. The gain scores under the objectives knowledge, understanding, application and skill were found significant.

Antonysamy (1989) undertook a study for teaching environmental concepts to school dropouts through video and charts. Findings showed that learning through viewing of the video film was more effective than learning through charts with reference to learning environmental concepts.

Prabhakar (1989) conducted a study entitled ‘Development of software for computer aided instruction and its comparison with traditional method for teaching ‘semiconductors’ at plus II level’. The findings of the study were:

(i) The CAI was found to be effective in terms of achievement of students belonged to class XI and class XII
(ii) The CAI was found to be effective in terms of reaction of students belonged to class XI and class XII
(iii) The CAI material was found to be significantly superior to the traditional method.

Ayoubi (1988) studied the effectiveness of microcomputer assisted instruction on achievement in High School Chemistry. Research findings showed that the students spending half their classroom instructional time to study chemistry from microcomputer programme reached the same level of achievement as students receiving instruction from teachers. High computer time users have made better achievement gains than low time users. The
significant difference between high and low ability students was erased if the low ability students spent more time on the computer than the high ability students.

Joseph (1988) made an attempt to determine if the achievement of the high school physics students can be improved through the use of microcomputers as part of their daily instruction. The study revealed that direct teach, lecture and discussion can be reduced by as much as 50 percent by adopting microcomputer student instructions, with significant effect on student achievement.

**Conclusion**

The foregoing research reviews made it clear that animation based instructional strategies has been attaining too much importance and significance in the field of education and attracting the attention of educational practitioners all over the world. The present review helped the researcher to define the scope and objectives of the study, formulate hypotheses and to get an insight into the methodology to be followed and how to construct and evaluate the tools. It also helped in the statistical interpretation of the data.