## REVIEW OF RELATED LITERATURE

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CHAPTER - II

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

The Literature Review is a thorough summary of the recognized facts and information in academic literature about a given subject. Most cited sources in a dissertation or thesis are listed in the Literature Review. It is important to remember at this time that reviewing literature is an evitable prerequisite to any research. The term “review” means revision or glances over or refers back on. Since effective research is based upon past knowledge, this step helps to eliminate the duplication of what has been done. It provides useful hypotheses and helpful suggestions for significant investigation.

A literature review is a description of the literature relevant to a particular field or topic. It gives an overview of what has been said, who the key writers are, what are the prevailing theories and hypotheses, what questions are being asked and what methods and methodologies are appropriate and useful. As such, it is not in itself primary research, but rather it reports on other findings.

2.2 OBJECTIVES OF THE RELATED LITERATURE

The review of related literature is an essential and significant aspect of a research process. A systematic review of the related literature can help the researcher the following ways. It can show how another researcher handled a similar problem

- suggest a method or technique of dealing problems
- reveal new sources of data which the researcher may not have known already
• introduce the researcher to the eminent personalities whose work may not have been known before

• Help the researcher to evaluate the research effort by comparing it with the efforts made by others.

The present study have been discussed with the following headings

1. Studies Related to Perceptual Skills

2. Studies Related to Visual skill

3. Studies Related to Auditory Skill

4. Studies Related to Kinesthetic skill

5. Studies Related to Haptic skill

6. Studies related to Olfactory skills.

7. Studies Related to Listening skill

8. Studies related to Achievement in Science

2.3 STUDIES RELATED TO PERCEPTUAL SKILLS

Andrew William (2017) conducted a study on Perceptual Skill in Soccer: Implications for Talent Identification and Development In this review, key components of perceptual skill in soccer are identified and implications for talent identification and development highlighted. Skilled soccer players can recall and recognize patterns of play more effectively than their less skilled counterparts. This ability to encode, retrieve and recognize sport-specific information is due to complex and discriminating long-term memory structures and is crucial to
anticipation in soccer. Similarly, experts use their knowledge of situational probabilities (i.e. expectations) to anticipate future events. They have a better than average idea of what is likely to happen given a particular set of circumstances. Also, proficiency-related differences in visual search strategy are observed. Skilled players use their superior knowledge to control the eye movement patterns necessary for seeking and picking up important sources of information. The nature of the task plays an important role in constraining the type of search used. Skilled soccer players use different search strategies when viewing the whole field (i.e. 11 vs 11 situations) compared with micro-states of the game (i.e. 1 vs 1, 3 vs 3 situations). Visual search behaviour also differs between defensive and offensive plays. These observations have implications for the development of perceptual training programmes and the identification of potential elite soccer players.

Ebersole, Tela M.; Kelty-Stephen, Damian G. (2017) showed that Psychology as an Evolving, Interdisciplinary Science: Integrating Science in Sensation and Perception from Fourier to Fluid Dynamics This research outlines the theoretical rationale and process for an integrated-science approach to teaching sensation and perception (S&P) to undergraduate psychology students that may also serve as an integrated-science curriculum. The course aimed to introduce the interdisciplinary evolution of this psychological field irrespective of any presumed distinctions between hard and soft science. The class began with perceptual science's foundations in Fourier decomposition and culminated in more recent developments with the perceptual science's interest in pattern-formation phenomena from fluid dynamics, and class illustrated this transition with various applications in music, art, and materials science. Post-course responses to the Research on Integrated Science Curriculum survey demonstrated that our students made significantly large gains in
course elements, specifically making the most of the students pre-existing experiences. We find that students are ready and willing to engage in the study of S&P by setting aside neuroscience's sometimes constraining assumptions.

Broadbent DP1, Causer J1, Williams (2017) examined that the role of error processing in the contextual interference effect during the training of perceptual-cognitive skills. The contextual interference (CI) effect refers to the learning benefits that occur from a random compared with blocked practice order. In this research, the cognitive effort explanation for the CI effect was examined by investigating the role of error processing. In 2 experiments, a perceptual-cognitive task was used in which participants anticipated 3 different tennis skills across a pretest, 3 practice sessions, and retention test. During practice, the skills were presented in either a random or blocked practice order. In Experiment 1, cognitive effort was examined using a probe reaction time (RT) task. In Experiment 2, cognitive effort was manipulated for 2 groups by inserting a cognitively demanding secondary task into the intertrial interval. The CI effect was found in both experiments as the random groups displayed superior learning in the retention test compared with the blocked groups. Cognitive effort during practice was greater in random compared to blocked practice groups in Experiment 1. In Experiment 2, greater decrements in secondary task performance following an error were reported for the random group when compared with the blocked group. The suggestion is that not only the frequent switching of tasks in randomized orders causes increased cognitive effort and the CI effect, but it is also error processing in combination with task switching. Findings extend the cognitive effort explanation for the CI effect and propose an alternative hypothesis highlighting the role of error processing.
Sattizahn, Jason R.; Lyons, Daniel J.; Kontra, Carly; Fischer, Susan M.; Beilock, Sian L. (2015) had a study on In Physics Education, Perception Matters. Student difficulties in science learning are frequently attributed to misconceptions about scientific concepts. We argue that domain-general perceptual processes may also influence students' ability to learn and demonstrate mastery of difficult science concepts. Using the concept of center of gravity (CoG), we show how student difficulty in applying CoG to an object such as a baseball bat can be accounted for, at least in part, by general principles of perception (i.e., not exclusively physics-based) that make perceiving the CoG of some objects more difficult than others. In particular, it is perceptually difficult to locate the CoG of objects with asymmetric-extended properties. The basic perceptual features of objects must be taken into account when assessing students' classroom performance and developing effective science, technology, engineering, and mathematics (STEM) teaching methods.

Song et al (2011) conducted a study on relating inter-individual differences in metacognitive performance on different perceptual tasks. Human behavior depends on the ability to effectively introspect about our performance. For simple perceptual decisions, the introspective or metacognitive ability varies substantially across individuals and is correlated with the structure of focal areas in prefrontal cortex. The study found that interindividual differences were strongly correlated between the two tasks for metacognitive ability but not objective performance. Such stability of an individual’s metacognitive ability across different perceptual tasks indicates a general mechanism supporting metacognition independent of the specific task.
Savithiri (2006) conducted a study on impact of metacognitive strategies in enhancing perceptual skills among high school students in learning Geometry. The study found that student's achievement level had increased after implementation of metacognitive strategies and application of perceptual skills. The result of the study revealed that by using metacognitive strategies perceptual skills could be enhanced in learning Geometry. It was pointed out that both perceptual skills and metacognitive strategies were needed to learn Geometry.

Bruno, Parameswaran & Beena, (2006) found that The process of perception consists of three stages: selection, organization and interpretation We select information, to which we attend through our sense organs (Sight, sound, smells, taste, and touch). We mentally arrange the information so we can understand or make sense out of the information. Our interpretation is subjective and based on our values, needs, beliefs, experiences, expectations, involvement, self-concept, and other personal factors. Interpretation of information is based on past experience, new situation and other’s opinions. This indicates that our perception is not constant. Perceptions are usually changing, biased, coloured, or distorted by our unique set of experiences. Thus, perceptions are our personal interpretations of the real world.

Bonifacci, P. (2004) examined that perceptual, visual-motor abilities and intellectual skills in children with low, average and above average motor abilities. The participants were 144 children (aged 6-10 years) attending elementary school. Three groups of children were identified on the basis of their performance at the TGMD (Test of Gross Motor Development; Ulrich, D.A. (1985). TGMD, Test of Gross Motor Development. Austin, Texas: PRO-ED. Edizione Italiana a cura di D. Ianes, TEST TGM. Test. Results highlight a significant difference in visual-motor
integration between children with high and low gross-motor abilities, in the absence of significant differences in perceptual skills or intellectual ability

Paul Ward and A. Mark Williams (2003) conducted a study on Perceptual and Cognitive Skill Development in Soccer: The Multidimensional Nature of Expert Performance. This study examined the relative contribution of visual, perceptual, and cognitive skills to the development of expertise in soccer. Elite and sub-elite players, ranging in age from 9 to 17 years, were assessed using a multidimensional battery of tests. Four aspects of visual function were measured: static and dynamic visual acuity; stereoscopic depth sensitivity; and peripheral awareness. Perceptual and cognitive skills were assessed via the use of situational probabilities, as well as tests of anticipation and memory recall. Stepwise discriminant analyses revealed that the tests of visual function did not consistently discriminate between skill groups at any age. Tests of anticipatory performance and use of situational probabilities were the best in discriminating across skill groups. Memory recall of structured patterns of play was most predictive of age. As early as age 9, elite soccer players demonstrated superior perceptual and cognitive skills when compared to their sub-elite counterparts. Implications for training perceptual and cognitive skill in sport are discussed.

Marina MSchoemakerab Marleenvan (2001) conducted a study on Perceptual skills of children with developmental coordination disorder. The aim of this study was to investigate whether children with a Developmental Coordination Disorder (DCD) experience problems in the processing of visual, proprioceptive or tactile information. Different aspects of visual perception were tested with the Developmental Test of Visual Perception (DTVP-2), tactile perception was assessed with the Tactual Performance Test (TPT), and a manual pointing task was employed.
to measure the ability to use visual and proprioceptive information in goal-directed movements. Nineteen children with DCD and nineteen age and sex-matched controls participated in this study. Differences between groups were most pronounced in the subtests measuring visual–motor integration of the DTVP-2, and in two subtests measuring visual perception (visual closure and position in space). On average the children with DCD performed slightly below the norm for tactile perception, with only three children failing the norm. On the manual pointing task, children with DCD made inconsistent responses towards the targets in all three conditions (visual, visual–proprioceptive and proprioceptive condition). No significant differences between groups were found for absolute error. Inspection of the individual data revealed that only two children failed on the majority of perceptual tasks in the three modalities. Across tasks, no consistent pattern of deficits appeared, illustrating the heterogeneity of the problems of children with DCD.

Calvin F Nodine (1998) showed that Perceptual skill, radiology expertise, and visual test performance with NINA and WALDO Rationale and Objectives. The goal of this study was to determine if radiologists possess superior visual search and analysis skills compared with those of laypeople. In two experiments, radiologists and laypeople searched one of two complex pictorial scenes for hidden targets. Eye position was recorded during the search. Two measures of performance were obtained: accuracy of detecting targets as measured by using alternative free response receiver operating characteristic analysis and visual search efficiency as measured by using eye position analysis. Results There were no statistically significant differences in detection performance between radiologists and laypeople for either of the search tasks. Radiologists took longer on average to search the
images and to first fixate on the targets than did the laypeople. For both groups, true-positive and false-positive decisions were associated with longer dwell times than true-negative decisions. As with radiology search tasks, false-negative decisions were also associated with longer dwell times than true-negative decisions. Performance on two visual search and detection tasks indicate that radiologists do not possess superior visual skills compared with laypeople. Radiology expertise is more likely to be a combination of specific visual and cognitive skills derived from medical training and experience in detecting and determining the diagnostic importance of radiographic findings.

K. Sathian (1998) found that Perceptual learning, which is the improvement in perceptual performance due to practice, has been studied by psychologists for over a hundred years. Studies over the last two decades have shown that perceptual learning effects in the visual system are highly specific for a variety of properties of the training stimulus, including its location. A similar degree of specificity characterizes the auditory system. In the tactile system, learning effects are task-specific but transfer readily outside the trained location in many tasks. Selective attention may play an important role in shaping the specificity of perceptual learning, but its precise role in relation to other task requirements remains unclear. While the neural basis of these behavioural observations is far from being understood, perceptual learning effects appear to depend on plasticity of neuronal populations within sensory areas of the cerebral cortex.

Hamachek, (1995) examined that Perception is influenced by internal and external factors. One of the central assumptions of the constructivist approach to perception is that perception is not determined entirely by external stimuli. As a consequence, it is assumed that emotional and motivational states, together with
expectation and culture, may influence people’s perceptual hypotheses and thus their visual perception

Timothy A. Salthouse and Kenneth Prill (1983) proved that Analysis of a Perceptual Skill Four experiments were conducted with a trajectory-intersection (video game) task to identify the information-processing mechanisms responsible for performance differences associated with initial ability and practice. We concluded that proficiency differences associated with initial ability are largely attributable to differences in the revision of processing operations and, to a lesser extent, to differences in the effectiveness of some component operations. Practice-related proficiency differences were less associated with component revision differences, and there was no evidence that the performance improvement caused by practice was accompanied by an increase in the effectiveness of individual components.

Dr Robert Serpell (1979) conducted a study on How specific are perceptual skills? A cross-cultural study of pattern reproduction. Pattern reproduction tasks were presented in four different media to samples of urban Zambian and urban British schoolchildren. When the patterns were reproduced as wire models, the Zambian children excelled the British. When the patterns were reproduced by drawing, the British children excelled the Zambian. No reliable cross-cultural differences were found when the patterns were reproduced as plasticine models or as configurations of hand positions. Both cultural groups were equally adversely affected when required to perform the modelling tasks or the hand positions task blind-folded. The results are interpreted as suggesting that cross-cultural differences in performance of pattern reproduction tasks reflect different sets of highly specific perceptual skills rather than differences on broader cognitive variables such as practical intelligence, field-dependency or sensotypes.
Jean R. Harber (1979) found that Perceptual Skills Necessary for Success in Reading? Which Ones? Numerous reading and reading readiness programs have been made available to teachers over the years, constructed on the assumption that certain auditory and visual perceptual skills are prerequisites to successful achievement in academics, particularly reading. Many educators have suggested that children who have been labeled learning or reading disabled demonstrate deficits at the perceptual level. In fact, many of those who have been instrumental in the field of learning disabilities have suggested that all learning disabled children have perceptual processing problems and that these perceptual problems are at the root of their learning.

2.4 STUDIES RELATED TO VISUAL SKILLS

Offerdahl, Erika G.; Arneson, Jessie B.; Byrne, Nicholas (2017) conducted a study on Lighten the Load: Scaffolding Visual Literacy in Biochemistry and Molecular Biology. The development of scientific visual literacy has been identified as critical to the training of tomorrow's scientists and citizens alike. Within the context of the molecular life sciences in particular, visual representations frequently incorporate various components, such as discipline-specific graphical and diagrammatic features, varied levels of abstraction, and spatial arrangements of visual elements to convey information. Visual literacy is achieved when an individual understands the various ways in which a discipline uses these components to represent a particular way of knowing. Owing to the complex nature of visual representations, the activities through which visual literacy is developed have high cognitive load. Cognitive load can be reduced by first helping students to become fluent with the discrete components of visual representations before asking them to simultaneously integrate these components to extract the
intended meaning of a representation. They present taxonomy for characterizing one component of visual representations—the level of abstraction—as a first step in understanding the opportunities afforded students to develop fluency. Further, they demonstrate how our taxonomy can be used to analyze course assessments and spur discussions regarding the extent to which the development of visual literacy skills is supported by instruction within an undergraduate biochemistry curriculum.

Çayir, Aybala (2017) conducted a study on Analyzing the Reading Skills and Visual Perception Levels of First Grade Students; the purpose of this study was to analyze primary school first grade students' reading levels and correlate their visual perception skills. For this purpose, students' reading speed, reading comprehension, and reading errors were determined using The Informal Reading Inventory. Students' visual perception levels were also analyzed using Beery-Buktenica Developmental Visual Motor Coordination Test. Results have shown that most of the students were in the anxiety (poor) level (75%) and the rest of the children were in the instructional level (25%). It has been found that instructional level first grade students had better scores in reading speed, reading comprehension, and reading errors. They also had significantly (p<0.01) better scores on the visual perception test. The Pearson correlation test also indicated that there is a positive relation between visual perception skills (visual perception and visual motor coordination) and reading levels. It has been suggested that students' visual perception skills should be supported for successful reading processes.

Paek, Seungoh; Hoffman, Daniel L.; Black, John B. (2016) examined that Perceptual Factors and Learning in Digital Environments; the purpose of this study was to examine if student understanding of new material could be promoted by manipulating the perceptual factors experienced at the time of learning. It was
hypothesized that the thematic relevance of perceptual factors would be a significant contributor to learner understanding. To test this hypothesis, one hundred seventy-three (n = 173) first and second grade students with limited prior knowledge were introduced to multiplication using a virtual manipulative environment. While interacting with the environment, participants encountered varied levels of thematic relevance in the audio and bodily-kinesthetic modalities. The audio perceptual factor varied what learners heard while the kinesthetic perceptual factor varied how learners moved. The results show that changes in the sensory experience at the time of learning have a "bottom up" impact on learners' ability to process new content. Evidence also suggests that the thematic relevance of perceptual factors mediates learner understanding in different ways over different time scales. The study concludes with a discussion of design-related issues and suggestions for future research.

LaDue, Nicole D.; Libarkin, Julie C.; Thomas, Stephen R.(2015) found that Visual Representations on High School Biology, Chemistry, Earth Science, and Physics Assessments The pervasive use of visual representations in textbooks, curricula, and assessments underscores their importance in K-12 science education. For example, visual representations figure prominently in the recent publication of the Next Generation Science Standards (NGSS Lead States in Next generation science standards: for states, by states. Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS, 2013). Although assessments of the NGSS have yet to be developed, most students are currently evaluated on their ability to interpret science visuals. While numerous studies exist on particular visuals, it is unclear whether the same types of visuals are emphasized in all science disciplines. The present study is an evaluation of the similarities and differences of
visuals used to assess students' knowledge of chemistry, earth science, living environment (biology), and physics on the New York State Regents examination. Analysis of 266 distinct visual representations categorized across the four content examinations reveals that the frequency and type of visuals vary greatly between disciplines. Diagrams, Graphs, Tables, and Maps are the most prevalent across all science disciplines. Maps, Cartograms, and Time Charts are unique to the Earth Science examination, and Network Diagrams are unique to the living environment (biology) examination. This study identifies which representations are most critical for training students across the science disciplines in anticipation of the implementation and eventual assessment of the NGSS.

Dhanapal, Saroja; Kanapathy, Ravi; Mastan, Jamilah (2014) conducted a study on the role of visual arts in the teaching and learning of science among Grade 3 teachers and students. A mixture of qualitative and quantitative research design was used to discover the different perceptions of both teachers and students on the role of visual arts in science. The data for the research was obtained from an international school in Malaysia through a survey distributed to the teachers and students. The researchers identified how the usage of visual arts motivated students to learn science. The research was supported with literature reviews of various educationists. The study found that children's mental and physical development was not merely enhanced and stimulated through the learning of science alone but with the integration of visual arts which aids their growth and progress. The findings also indicated that almost all teachers and students gave positive views for the integration of visual arts in science lessons. Teachers noticed positive changes among their learners as they enjoyed the freedom of choosing their preferred form of art to express their learning of science. Teachers also noticed that integrating visual arts as
a medium to teach science motivated students to attain a higher level of achievement. Finally, it is concluded that visual arts play a useful role in the teaching and learning science. Since visual arts has been proven to play an important role in the development of individuals, the researchers advocate for its integration in science lessons at all levels of study to promote higher order thinking skills and abilities to survive in the 21st century.

Xiangzhi Meng, Alice Cheng-Lai, Biao Zeng, John F. Stein and Xiaolin Zhou (2011) conducted a study on Dynamic visual perception and reading development in Chinese school children. The development of reading skills may depend to a certain extent on the development of basic visual perception. The magnocellular theory of developmental dyslexia assumes that deficits in the magnocellular pathway, indicated by less sensitivity in perceiving dynamic sensory stimuli, are responsible for a proportion of reading difficulties experienced by dyslexics. Using a task that measures coherent motion detection threshold, this study examined the relationship between dynamic visual perception and reading development in Chinese children. Experiment 1 compared the performance of 27 dyslexics and their age- and IQ-matched controls in the coherent motion detection task and in a static pattern perception task. Results showed that only in the former task did the dyslexics have a significantly higher threshold than the controls, suggesting that Chinese dyslexics, like some of their Western counterparts, may have deficits in magnocellular pathway. Experiment 2 examined whether dynamic visual processing affects specific cognitive processes in reading. One hundred fifth-grade children were tested on visual perception and reading-related tasks. Regression analyses found that the motion detection threshold accounted for 11% and 12%, respectively, variance in the speed of orthographic similarity judgment and
in the accuracy of picture naming after IQ and vocabulary size were controlled. The static pattern detection threshold could not account for any variance. It is concluded that reading development in Chinese depends to a certain extent on the development of dynamic visual perception and its underlying neural pathway and that the impact of visual development can be specifically related to orthographic processing in reading Chinese.

McKenna, et al., (2006) conducted a study on Visual perception is the process of receiving, organizing and interpreting visual information. This requires a sophisticated analysis of environmental factors, particularly in contexts in which factors are abstract, novel and/or detailed or in circumstances where important visual information is obscured.

Kenneth A. Kavale and Steven R. Forness (2000) found that Auditory and Visual Perception Processes and Reading Ability: A Quantitative Reanalysis and Historical Reinterpretation Meta-analysis was used to integrate statistically the literature assessing the relationship between auditory and visual perception and reading achievement. From 267 studies conducted between 1950-1980, 2,294 correlation coefficients were collected and aggregated into homogeneous groupings across five auditory perceptual skills, eight visual perceptual skills, four reading skills, and two subject groups. Findings were interpreted through the binomial effect size display, which indicates the increase in predictive accuracy rather than the percent of variance explained (r2). Stepwise multiple-regression analyses were used to order perceptual skills in terms of their usefulness for predicting reading skills and to examine the role of intelligence in prediction. The findings indicated that auditory and visual perceptual skills can successfully increase the accuracy of predicting reading achievement, but the magnitude of the increases in predictive accuracy was
contingent upon the combination of variables studied and was significantly reduced if an IQ score was known. It was concluded that, while there was some justification for early conceptualizations of learning disability emphasizing perception, the limitations surrounding the magnitude and nature of the relationship between perceptual skills and reading as well as recent advances showing other processes holding greater promise for explaining reading disability, perceptual processes no longer need to be considered primary factors in predicting reading ability.

2.5 STUDIES RELATED TO AUDITORY SKILL

Zaltz, Yael; Roth, Daphne Ari-Even; Kishon-Rabin, Liat (2017) studied that the Role of External Feedback in Auditory Skill Learning Age Dependent? Purpose: The purpose of this study is to investigate the role of external feedback in auditory perceptual learning of school-age children as compared with that of adults. Method: Forty-eight children (7-9 years of age) and 64 adults (20-35 years of age) conducted a training session using an auditory frequency discrimination (difference limen for frequency) task, with external feedback (EF) provided for half of them. Results: Data supported the following findings--(a) Children learned the difference for frequency task only when EF was provided. (b) The ability of the children to benefit from EF was associated with better cognitive skills. (c) Adults showed significant learning whether EF was provided or not. (d) In children, within-session learning following training was dependent on the provision of feedback, whereas between-sessions learning occurred irrespective of feedback. Conclusions: EF was found beneficial for auditory skill learning of 7-9-year-old children but not for young adults. The data support the supervised Hebbian model for auditory skill learning, suggesting combined bottom-up internal neural feedback controlled by top-
down monitoring. In the case of immature executive functions, EF enhanced auditory skill learning. This study has implications for the design of training protocols in the auditory modality for different age groups, as well as for special populations.

**Sarro EC1, Sanes DH1 (2014)** found that a few juvenile auditory perceptual skills correlate with adult performance. Measures of human mental development suggest that behavioral skills displayed during early life can predict an individual's subsequent cognitive performance. Support for this draws from longitudinal studies that reveal compelling within-subject correlations during childhood. If this idea applies across the life span, then correlations in performance should persist into adulthood. Here, we address this prediction in juvenile and adult gerbils by evaluating within-subject measures of auditory learning and perception. Animals were trained and tested as juveniles on either an amplitude modulation (AM) or a frequency modulation (FM) detection task. Measures of learning and perception obtained from juveniles were then compared to similar measures obtained when each subject was tested in adulthood on either the same task or the untrained task. For animals trained and tested on the AM detection task as juveniles and adults, there was no correlation between juvenile and adult learning metrics, or perceptual sensitivity. For animals trained and tested on FM detection as juveniles, we observed a significant relationship to their adult performance. Juveniles that performed the best on FM detection were the poorest at AM detection, and the best at FM detection, when tested as adults. Thus, across-age correlations for sensory and cognitive measures, obtained during development and in adulthood, depend heavily on the specific type of developmental experience and the outcome measure.
Besken, Miri; Mulligan, Neil W. (2014) found that Perceptual Fluency, Auditory Generation, and Metamemory: Analyzing the Perceptual Fluency Hypothesis in the Auditory Modality Judgments of learning (JOLs) are sometimes influenced by factors that do not impact actual memory performance. One recent proposal is that perceptual fluency during encoding affects metamemory and is a basis of metacognitive illusions. In the present experiments, participants identified aurally presented words that contained inter-spliced silences (the generate condition) or that were intact, a manipulation analogous to visual generation manipulations. The generate condition produced lower perceptual fluency as assessed by both accuracy and identification latency. Consistent with the perceptual fluency hypothesis, the less fluent, generate condition produced lower JOLs than the intact condition. However, actual memory performance was greater in the generation than intact condition in free recall (Experiment 1) and recognition (Experiment 3). The negative effect of generation on JOLs occurred for both aggregate and item-by-item JOLs, but in the latter case, the positive generation effect in actual memory performance was reduced or eliminated (as also occurs with visual generation tasks; Experiments 2 and 4). Furthermore, the decrease in perceptual fluency produced by the generation manipulation was correlated with the decrease in JOLs for this condition (Experiment 5). The negative effect of generation on JOLs persisted even when participants were warned that the generation condition produces equal or greater memory performance compared to the intact condition (Experiment 6). The results are in accord with the perceptual fluency hypothesis and show that this metamemory illusion is related to objective measures of perceptual difficulty. With regard to actual memory performance, this novel auditory generation manipulation produces results consistent with those produced in the visual modality.
Gregg, Melissa K.; Samuel, Arthur G. (2012) showed that Feature Assignment in Perception of Auditory Figure because the environment often includes multiple sounds that overlap in time, listeners must segregate a sound of interest (the auditory figure) from other co-occurring sounds (the unattended auditory ground). We conducted a series of experiments to clarify the principles governing the extraction of auditory figures. We distinguish between auditory "objects" (relatively punctuate events, such as a dog's bark) and auditory "streams" (sounds involving a pattern over time, such as a galloping rhythm). In Experiments 1 and 2, on each trial 2 sounds—an object (a vowel) and a stream (a series of tones)—were presented with 1 target feature that could be perceptually grouped with either source. In each block of these experiments, listeners were required to attend to 1 of the 2 sounds, and report its perceived category. Across several experimental manipulations, listeners were more likely to allocate the feature to an impoverished object if the result of the grouping was a good, identifiable object. Perception of objects was quite sensitive to feature variation (noise masking), whereas perception of streams was more robust to feature variation. In Experiment 3, the number of sound sources competing for the feature was increased to 3. This produced a shift toward relying more on spatial cues than on the potential contribution of the feature to an object's perceptual quality. The results support a distinction between auditory objects and streams, and provide new information about the way that the auditory world is parsed.

Kuppen, Sarah; Huss, Martina; Fosker, Tim; Fegan, Natasha; Goswami, Usha (2011) conducted a study on Basic Auditory Processing Skills and Phonological Awareness in Low-IQ Readers and Typically Developing Controls We explore the relationships between basic auditory processing, phonological
awareness, vocabulary, and word reading in a sample of 95 children, 55 typically developing children, and 40 children with low IQ. All children received no speech auditory processing tasks, phonological processing and literacy measures, and a receptive vocabulary task. Compared to age-matched controls, the children with low IQ and low reading skills were significantly impaired in auditory and phonological processing, whereas the children with low IQ and preserved reading skills were not. There were also significant predictive relations between auditory processing and single word reading. Poor auditory processing was not dependent on low IQ, as auditory processing was age appropriate in the low-IQ children who were good readers.

Michey, Christophe; Hunter, Cynthia; Oxenham, Andrew J. (2010) examined that Auditory Stream Segregation and the Perception of Across-Frequency Synchrony. This study explored the extent to which sequential auditory grouping affects the perception of temporal synchrony. In Experiment 1, listeners discriminated between 2 pairs of asynchronous "target" tones at different frequencies, A and B, in which the B tone either led or lagged. Thresholds were markedly higher when the target tones were temporally surrounded by "captor tones" at the A frequency than when the captor tones were absent or at a remote frequency. Experiment 2 extended these findings to asynchrony detection, revealing that the perception of synchrony, one of the most potent cues for simultaneous auditory grouping, is not immune to competing effects of sequential grouping. Experiment 3 examined the influence of ear separation on the interactions between sequential and simultaneous grouping cues. The results showed that, although ear separation could facilitate perceptual segregation and impair asynchrony detection, it did not prevent the perceptual integration of simultaneous sounds.
2.6 STUDIES RELATED TO KINESTHETIC SKILLS

Whitworth, Brooke A.; Chiu, Jennifer L.; Bell, Randy L. (2014) conducted a study on Kinesthetic Investigations in the Physics Classroom. Creating investigations that allow students to see physics in their everyday world and to be kinesthetically active outside of the traditional physics classroom can be incredibly engaging and effective. In this study in which students engaged in concrete experiences before that the concepts and derived the mathematical relationships. In this research, to describe the approach to inquiry used and an explanation of kinesthetic investigations in general. It will provide a description of several of the investigations and some examples of how students responded to them.

Kuan-yi Liab Wei-jen Suc Hsuan-wei Fud Kristen A. Pickette (2015) showed that kinesthetic deficit in children with developmental coordination disorder. The aim of this study was to measure and compare kinesthetic sensitivity in children with developmental coordination disorder (DCD) and typically developing (TD) children between 6 and 11 years old. 30 children with DCD aged 6 to 11 years (5 in each age group) and 30 TD children participated in the study. Participants placed their forearms on a passive motion apparatus which extended the elbow joint at constant velocities between 0.15 and 1.35° s−1. Participants were required to concentrate on detection of passive arm motion and press a trigger held in their left hand once they sensed it. The detection time was measured for each trial. The DCD group was significantly less sensitive in detection of passive motion than TD children. Further analysis of individual age groups revealed that kinesthetic sensitivity was worse in DCD than TD children for age groups beyond six years of age. Our findings suggested that individual with DCD lag behind their TD counterparts in kinesthetic sensitivity. Between the ages of 7 and 11 years the difference between groups is
quantifiable and significant with 11 year old children with DCD performing similar to 7 year old TD children.

**Bonwell, Charles C. and James A. Einson (2006)** experimented that active learning as one strategy in teaching English to elementary school students who are kinesthetic learners. Teaching English is not only transferring knowledge from the source of information to the students, but also considering about the learning strategies and learners’ learning style. Elementary school students who are kinesthetic learners need to be taught using an appropriate strategy in order to make learning English is effective. There is a tendency of the teachers to teach English using conventional way that is lecturing. For elementary school students, it will not really work since they need to learn something by moving. To make learning English is effective for elementary school students, the teacher needs to consider active learning as one strategy to teach English to elementary school students who are kinesthetic learners.

**Warren Haston (2010)** examined that Beginning Wind Instrument Instruction: A Comparison of Aural and Visual Approaches. The purpose of this study was to assess the effectiveness of teaching beginning wind instrumentalists using a sound-before-sight (aural) approach, designed to foster the connections between eyes, ears, and fingers; and capitalize on students' musical intuitions. Participants received one hour of weekly instruction for 15 weeks. One group (n = 10) was taught with an aural/modeling emphasis (singing while fingering, playing-by-ear, call and response, playing from printed music), and one (n = 10) with a visual emphasis (playing from printed music). T-tests showed that the aural/modeling group scored higher on two posttests, the Watkins Farnum Performance Scale and a prepared piece, though not significantly. Aural/modeling
participants without prior training scored the highest followed by visual participants with prior training. There was a significant ($r = .668$, $p < .01$) and positive relationship between posttest scores. Teaching with an aural/modeling emphasis does not hamper participants' music performance skills, and may aid them.

Nancy M. Gamso (2011) conducted a study on An Aural Learning Project: Assimilating Jazz Education Methods for Traditional Applied Pedagogy, The Aural Learning Project (ALP) was developed to incorporate jazz method components into the author's classical practice and her applied woodwind lesson curriculum. The primary objective was to place a more focused pedagogical emphasis on listening and hearing than is traditionally used in the classical applied curriculum. The components of the ALP for the applied studio are (1) listening to at least two professional recordings of the works currently being studied and analyzing the performances, (2) recording projects with a written evaluation of the performance, (3) Smart Music practice, (4) memorization and transcription projects, (5) assigned readings and research on works studied, and (6) composed and improvised warm-up and technique exercises. This research is a report on the project and a description of its implementation and assessment.

Michael J. Kendal (1988) focused that Two Instructional Approaches to the Development of Aural and Instrumental Performance Skills, The purpose of this study was to determine whether beginning instrumental students taught with a modeling (aural and kinesthetic) mode of instruction would develop better aural musicianship and instrumental performance skills than would beginning instrumental students taught with a comprehensive (aural, kinesthetic, and visual) mode of instruction. The author randomly assigned students from four intact instrumental classes ($N = 76$) to either a modeling or a comprehensive treatment.
The instructional activities for these treatments consisted of a sequence of imitation, discrimination, and association activities. The primary difference between the groups was that the comprehensive treatment included music reading activities but the modeling treatment did not. Test score analyses indicated that differences between the groups were not significant on the ear-to-hand coordination test and the performance test but were significant, favoring the comprehensive treatment, on the verbal association test and the sight-reading test. The data indicated that the introduction of music reading activities did not impede the development of students' aural and instrumental performance skills.

**Stephen C. Larsen and Floyd G. Hudson** (1973) examined that Oral Kinesthetic Sensitivity and the Perception of Speech. The present research was undertaken to explore the relationship between auditory ability and oral form discrimination in individuals with varying degrees of development in speech and language. The results of the 2 studies lend support to the motor theory of speech perception, which posits that accurate interpretation of speech involves not only an adequate auditory system but also feedback from the speaker's own articulatory movements. The groups studied included achieving and underachieving second-, third-, and fourth-grade children as well as selected deaf, blind, and normal children. Future studies should be conducted to further delineate the role of oral kinesthetic sensitivity and its relationship to speech perception.

**2.7 STUDIES RELATED TO HAPTIC SKILL**

**Magana, Alejandra J.; Balachandran, Sadhana** (2017) conducted a study on Students' Development of Representational Competence through the Sense of Touch. Electromagnetism is an umbrella encapsulating several different concepts like...
electric current, electric fields and forces, and magnetic fields and forces, among other topics. However, a number of studies in the past have highlighted the poor conceptual understanding of electromagnetism concepts by students even after instruction. This study aims to identify novel forms of "hands-on" instruction that can result in representational competence and conceptual gain. Specifically, this study aimed to identify if the use of visuohaptic simulations can have an effect on student representations of electromagnetic-related concepts. The guiding questions is "How do visuohaptic simulations influence undergraduate students' representations of electric forces?" Participants included nine undergraduate students from science, technology, or engineering backgrounds who participated in a think-aloud procedure while interacting with a visuohaptic simulation. The think-aloud procedure was divided in three stages, a prediction stage, a minimally visual haptic stage, and a visually enhanced haptic stage. The results of this study suggest that students' accurately characterized and represented the forces felt around a particle, line, and ring charges either in the prediction stage, a minimally visual haptic stage or the visually enhanced haptic stage. Also, some students accurately depicted the three-dimensional nature of the field for each configuration in the two stages that included a tactile mode, where the point charge was the most challenging one.

Johannes, Kristen; Powers, Jacklyn; Couper, Lisa; Silberglitt, Matt; Davenport, Jodi (2016) conducted a study on Tangible Models and Haptic Representations Aid Learning of Molecular Biology Concepts Can novel 3D models help students develop a deeper understanding of core concepts in molecular biology? We adapted 3D molecular models, developed by scientists, for use in high school science classrooms. The models accurately represent the structural and functional properties of complex DNA and Virus molecules, and provide visual and haptic
feedback about biomolecular properties that are often implicit in traditional models. We investigated: 1) Can we measure conceptual growth on core concepts? 2) Do lessons with 3D models improve student outcomes on these measures?, and 3) What factors mediate learning? Model use yielded measurable gains in conceptual knowledge and the greatest gains were related to how actively models were used during a lesson and the facilitative role adopted by the teachers.

**Gori, Monica; Giuliana, Luana; Sandini, Giulio; Burr, David (2012)** showed that Visual Size Perception and Haptic Calibration during Development. It is still unclear how the visual system perceives accurately the size of objects at different distances. One suggestion, dating back to Berkeley's famous essay, is that vision is calibrated by touch. If so, we may expect different mechanisms involved for near, reachable distances and far, unreachable distances. To study how the haptic system calibrates vision we measured size constancy in children (from 6 to 16 years of age) and adults, at various distances. At all ages, accuracy of the visual size perception changes with distance, and is almost veridical inside the haptic workspace, in agreement with the idea that the haptic system acts to calibrate visual size perception. Outside this space, systematic errors occurred, which varied with age. Adults tended to overestimate visual size of distant objects (over-compensation for distance), while children younger than 14 underestimated their size (under-compensation). At 16 years of age there seemed to be a transition point, with veridical perception of distant objects. When young subjects were allowed to touch the object inside the haptic workspace, the visual biases disappeared, while older subjects showed multisensory integration. All results are consistent with the idea that the haptic system can be used to calibrate visual size perception during
development, more effectively within than outside the haptic workspace, and that the calibration mechanisms are different in children than in adults.

Jones, M. Gail; Minogue, James; Tretter, Thomas R.; Negishi, Atsuko; Taylor, Russell (2006) conducted a study on Haptic Augmentation of Science Instruction: Does Touch Matter? This study investigated the impact of haptic augmentation of a science inquiry program on students' learning about viruses and nanoscale science. The study assessed how the addition of different types of haptic feedback (active touch and kinesthetic feedback) combined with computer visualizations influenced middle and high school students' experiences. The influences of a PHANToM (a sophisticated haptic desktop device), a Sidewinder (a haptic gaming joystick), and a mouse (no haptic feedback) interface were compared. The levels of engagement in the instruction and students' attitudes about the instructional program were assessed using a combination of constructed response and Likert scale items. Potential cognitive differences were examined through an analysis of spontaneously generated analogies that appeared during student discourse. Results showed that the addition of haptic feedback from the haptic-gaming joystick and the Phantom provided a more immersive learning environment that not only made the instruction more engaging but may also influence the way in which the students construct their understandings about abstract science concepts.

2.8 STUDIES RELATED TO OLFACTORY SKILLS

Dhemba Ishmae (2015) conducted a research on the Use of Auditory, Tactual, Olfactory and Kinaesthetic Senses In Developing Orientation and Mobility (O & M) Skills to Learners with Congenital Blindness. This research paper attempted to study the importance of the multisensory approach in developing
orientation and mobility (O&M) skills to learners with congenital blindness (CB). The research’s focus was on the use of the auditory, tactual, olfactory and kinesthetic senses. The research was made a case study, based on a qualitative and narrative inquiry approach. From the defined population consisting of learners with visual impairment, a sample size of six (6) participants was chosen. This comprised of three (3) pupils with congenital blindness (CB) and their three (3) teachers. Since this was a case study, purposive sampling was employed to get the participants. This was achieved by going straight to information-rich individuals, which Grinne (1993) describes, as those likely to be knowledgeable and informative about the use of extrasensory perceptions (as alternative to total loss of vision), in the acquisition of O&M skills. In qualitative research design, credibility, transferability, dependability and conformability are important validity issues to consider (McCleod, 1994). In this study, validity was enhanced by means of triangulation, where data generation was made through Interviews, Observations and Document Analysis, were the instruments used in the study. Research findings revealed that children with CB depend on the multisensory approach in developing O&M skills. The research has important implications for teachers and other stakeholders in the O&M skill acquisition for learners with CB. Recommendations advanced in this research remind teachers, who might not have a strong, and hence a weak knowledge base about the multisensory approach, to be cognisant of the importance of compensatory senses in O&M skill acquisition for children with CB

Ephraim S Grossman (2015) a study on Performance of Early-Blind and Sighted Children on Olfactory Tasks The goal of the study was to test whether children with congenital or early-onset blindness outperform sighted children on olfactory tasks. Measures of olfactory sensitivity, odour recognition, and odour
labeling were obtained. The results show that the blind children were more proficient at correctly labeling 25 common odours than were matched sighted children. However, the blind were not more sensitive to a target odour, nor more proficient at choosing a correct odour label from a list of four. Together, the data point to a circumscribed advantage of blind children at self-generating and retrieving odour labels and, as such, to a limited, but still compensatory, cognitive function.

Lea Gagnon, Abd Rahman Alaoui Ismaili, (2015) made a research on
Sight is undoubtedly important for finding and appreciating food, and cooking. Blind individuals are strongly impaired in finding food, limiting the variety of flavours they are exposed to. We have shown before that compared to sighted controls, congenitally blind individuals have enhanced olfactory but reduced taste perception. In this study we tested the hypothesis that congenitally blind subjects have enhanced orthonasal but not retronasal olfactory skills. Twelve congenitally blind and 14 sighted control subjects, matched in age, gender and body mass index, were asked to identify odours using grocery-available food powders. Results showed that blind subjects were significantly faster and tended to be better at identifying odours presented orthonasally. This was not the case when odorants were presented retronasally. We also found a significant group x route interaction, showing that although both groups performed better for retronasally compared to orthonasally presented odours, this gain was less pronounced for blind subjects. Finally, our data revealed that blind subjects were more familiar with the orthonasal odorants and used the retronasal odorants less often for cooking than their sighted counterparts. These results confirm that orthonasal but not retronasal olfactory perception is enhanced in congenital blindness, a result that is concordant with the reduced food variety exposure in this group.
Schneider, Elaine Fogel; Patterson, Philip P. (2010) conducted a study on Got That Magic Touch: Integrating the Sense of Touch into Early Childhood Services. Newborns have often been characterized as helpless. However, more recent research suggests that infants are armed with an arsenal of sensory and perceptual abilities that enable them to organize and attach meaning to the world. Examples of such abilities include visual, auditory, olfactory, and gustatory skills. Although initially primitive, these abilities become more refined over time and with experience. Touch is another example of a sensory skill with which children are born. The use of massage and acupressure are examples of touch. Especially for young children with disabilities, massage and acupressure are a more structured and systematic form of touch and require specialized training by certified and/or licensed professionals. In this article, the authors discuss how to integrate the sense of touch into early childhood services. They discuss the cultural and religious aspects of touch, policies about touch, and the benefits of touch for young children with special needs. They describe the A-B-Cs of promoting nurturing touch and massage.

Burhan Akpınar (2005) made a study on the Effects of Olfactory Stimuli on Scholastic Performance. The research described in this paper was carried out to determine the effects of olfactory stimuli (provided by natural essence oils of lemon) on achievement in English of fourth grade pupils in a school in Turkey. Pupils were randomly assigned to an experimental group (n:29) or a control group (n:29). Both groups were taught English lessons twice a week for a period of four weeks as part of the normal curriculum. In the experimental group, lessons were provided in an aromatic atmosphere. In the control group, lessons were provided in a normal classroom environment. Following treatment, the experimental group outperformed the control group on an achievement test in English. A month after the termination
of treatment, the performance of both groups on the achievement test had deteriorated, but the experimental group still outperformed the control group.

**J. Patrick Kesslak, Beatrice F. Profit, Phillip Criswell (1991)** made a research on Olfactory Function in Chronic Alcoholics patients participating in an outpatient program for chronic alcohol abuse and 8 age-matched controls were tested for olfactory function. There was a significant difference between the two groups on a match-to-sample test using uncommon odors but not on a smell identification test using common odors. Ability to detect and identify common odors does not appear to be impaired by chronic alcohol abuse. Deficits on the odor-matching task may be related to difficulty in encoding olfactory information rather than a primary olfactory deficit.

**W. S., & Gent, J. F. (1991).** Conducted a study on Olfactory sensitivity: Reliability, generality, and association with aging. Journal of Experimental Psychology: Human Perception and Performance, 17(2), 382-391. Olfactory sensitivity: Reliability, generality, and association with aging. 32 Ss (aged 22–59 yrs) yielded detection thresholds for 4 odorants over 4 sessions. The thresholds decreased and reliability increased over the course of testing. High intercorrelations between odorants and the stability of an S's relative position within the threshold distributions showed that a general factor of sensitivity dominated the outcome. Age contributed strongly to inter-S variation. Even among these nonelderly individuals, it accounted for up to 2 orders of magnitude in threshold performance. Other important factors included superiority of the right nostril and a negative correlation between the mean and variance of threshold distributions. Scant attention to the correlation may have contributed to overestimation of the frequency and specificity of specific
anosmia. A clinically relevant outcome was that measurement of threshold for diagnostic purposes can generally rely on just odorant.

2.9 STUDIES RELATED TO LISTENING SKILL

Cigerci, Fatih Mehmet; Gultekin, Mehmet (2017) examined that Use of Digital Stories to Develop Listening Comprehension Skills The aim of this study was to determine the effect of digital stories on the Turkish (mother language) listening skills of fourth grade students. The study used a mixed methods and was conducted in two fourth grade classrooms (ages 9-10 years) in a primary school in Eskisehir city, Turkey, during the 2014-2015 spring semester. During the 8-week application process, Turkish lessons were conducted using digital stories and activities were designed depending on the digital stories. While the lesson plans were put into action by the classroom teacher, the researcher observed the process. Research data were obtained also from a listening comprehension test, and teacher and student interviews. Quantitative data from the listening comprehension test was analysed using t-tests, and the qualitative data was subjected to descriptive analysis. A significant difference was found between the post-test listening comprehension scores for the experimental and control groups. The qualitative data from student and teacher interviews, and from classroom observations, showed that digital stories, listening activities based on the stories, and the creation of a more engaging and motivating classroom environment had positive effects on listening comprehension skills in the experimental group.

Acat, M. Bahaddin; Demiral, Hilmi; Kaya, Mehmet Fatih (2016) conducted a study on Measuring Listening Comprehension Skills of 5th Grade School Students with the Help of Web Based System The main purpose of this
study is to measure listening comprehension skills of 5th grade school students with the help of web based system. This study was conducted on 5th grade students studying at the primary schools of Eskisehir. The scale used in the process of the study is "Web Based Listening Scale". In the process of the study, the level of differentiation listening skill and educational level of mother and father, family income level, Turkish Course grading note and the most popular and listened music genre were investigated. According to the obtained results there is a significant difference was found with listening skills and educational level of mother and father, family income level and the most popular and listened music genre. Also it was found that there is a powerful relationship between listening skills and Turkish Course grading note. In the process of the research, it was observed that the students used the web based system are more attentive and motivated. Nevertheless, personalized measuring environment was provided by the web based system. Finally, it can be said that the web based systems can be used positively for language learning, teaching, and instruction, improving, measuring and assessing process.

Betty Preus, Rachel Payne, Carly Wick and Emily Glomski (2016) proved that Listening to the Voices of Civically Engaged High School Students This study examines why a group of students representing two high schools became involved in an activist organization, the benefits they gained as a result, the impact they had on their school and community, and their recommendations for how school personnel can foster civic engagement in young people. The student-led group campaigned for a school levy, produced a documentary on diversity, hosted a Community Forum on school climate, and educated classmates on the root causes of hunger. Data were analyzed through the lens of positive youth development theory.
Findings confirmed previous research suggesting the bi-directional nature of development, in which young people with significant developmental assets both contributed to the community and garnered additional assets as a result of their engagement. Members of the group recommended that school personnel invite and value student input, foster respectful discourse on controversial issues, show students models of engagement in the community and invite them to become involved, facilitate access to resources, and mentor students on navigating systems.

The researchers recommend that school personnel foster a school climate conducive to civic engagement, nurture student leadership among all demographic groups, and promote opportunities for collective action on issues relevant to students' lived experiences.

Solak, Ekrem; Altay, Fırat (2014) showed that Prospective EFL Teachers' Perceptions of Listening Comprehension Problems in Turkey Listening skill has been called as the "Cinderella Skill" which is overlooked by its elder sister speaking in language learning. Therefore, the purpose of the study was to reemphasize the importance of listening skill in ELT context and to determine prospective English teachers' perceptions of listening comprehension problems. The study was conducted at ELT Department at a state-run University in Turkey and subjects were 124 prospective English teachers. The questionnaire on the "Beliefs on English Language Listening Comprehension Problems" was used to collect data to assess prospective teachers' beliefs about the English language listening comprehension problems they could encounter in unidirectional listening. The data was analyzed in SPSS program. The study revealed that participants used top-down processes effectively during the listening process, but they were not so good at using bottom-
up processes. In addition, no significant difference was found in terms of genders' perceptions of listening problems.

**Wolvin, Andrew (2013)** found that Understanding the Listening Process: Rethinking the "One Size Fits All" Model Robert Bostrom's seminal contributions to listening theory and research represent an impressive legacy and provide listening scholars with important perspectives on the complexities of listening cognition and behavior. Bostrom's work provides a solid foundation on which to build models that more realistically explain how listeners function differently in different communication contexts and how speakers can facilitate successful listening in those contexts. Summarizing his research, Bostrom (1997) concludes that "we all vary in our ability to listen" an important reminder that a "one size fits all" model of the listening process may be a conceptual barrier to truly understanding what makes for successful listening.

**Rhoda Feldman (2002)** conducted a study on **Listening** to Student Voices Student voices are rarely included in discussions of strategies for solving educational problems. The perspectives of children from disempowered and dominated communities are particularly invisible (Nieto, 1994). This article examines an arts integration residency at Hampton, an innercity public elementary school in Chicago in which 99.9% of the students are African American and 94.1% low income. Its purpose is to document the voices of the children participating in the program and to develop an understanding of the residency from their perspective. The research focuses on one of the themes that emerged in interviews and observations: the importance of personal connections to art.
2.10 STUDIES RELATED TO AURAL SKILL

Hallam, Susan (2017) conducted a study on The Impact of Making Music on Aural Perception and Language Skills: This research provides a synthesis of research on the relationship between music and language, drawing on evidence from neuroscience, psychology, sociology and education. It sets out why it has become necessary to justify the role of music in the school curriculum and summarizes the different methodologies adopted by researchers in the field. This research exploring the way that music and language are processed, including differences and commonalities; addresses the relative importance of genetics versus length of time committed to, and spent, making music; discusses theories of modularity and sensitive periods; sets out the OPERA hypothesis; critically evaluates research comparing musicians with non-musicians; and presents detailed accounts of intervention studies with children and those from deprived backgrounds, taking account of the importance of the nature of the musical training. It concludes that making music has a major impact on the development of language skills.

Siegel, Joseph (2016) conducted a study on Listening Vocabulary: Embracing Forgotten Aural Features It describes an innovation in the teaching and learning of vocabulary in English as a Foreign Language classes. Whereas vocabulary coverage in classrooms and textbooks traditionally focuses on lists of target words in printed form, this article promotes the notion of "aural vocabulary" as an important part of "knowing" words. It describes a set of activities used to improve learners' academic listening abilities and illustrates the activities by using the Academic Word List.
**Barlow, Sarah (2016)** examined that Improving Aural Skills within the Curriculum: A Literature Review Success in music theory studies appears to be simply a matter of learning the rules and applying them. This is not the case with aural skills, which include labeling a scale played on piano, or writing a rhythm heard on a drum. Student success in aural tasks is not always consistent, and the student skill seems to fade over time if there is no practice on a regular basis. Final music examinations, such as Victorian Certificate of Education and tertiary entrance exams, don't allow students to reproduce the sound during the examination. The reason for this is obvious students cannot share results in an exam situation--but this also makes for a much more difficult task. The following literature review explores various approaches which could be of use in the Australian classroom.

**Baskaran, M. (2011)** found that Aural-Oral Communicative Skills among Yemeni Secondary Level Students Many attempts are currently being made to develop Aural-Oral Communicative skills in English at school level, but it remains a difficult task for the teachers of English. There are a lot of readymade cassettes available in the market but they have hardly served the purpose. Admittedly, cassettes help and yield better results for learners, subject to teacher's competence to utilize them. English is a foreign language for Yemeni students at all levels: preparatory, secondary and tertiary. It is considered as a difficult subject due to the mother tongue interference. But the optimum use of audio cassettes developed by the teachers will help to achieve the desired results. In the present study, the basic skills were taken as tasks and simple tests were administered on the students, who start learning English at the age of eleven. Their mother tongue interference is deep-rooted and so they have difficulties in learning English.
Klonoski, Edward (2006) conducted a study on Improving Dictation as Aural-Skills Instructional Tool. Many high schools in the U.S. offer Advanced Placement (AP) courses in music theory for students wishing to study music at the college level. Others devote part of the music curriculum to theory and aural-skills instruction, but do not offer AP courses. In case, high school theory and aural-skills courses typically strive to cover all, or part, of the material presented in first-semester college theory and aural-skills courses. Music dictation is a mainstay in most college aural-skills classes, and the College Board advocates including dictation in AP music theory courses. However, dictation's effectiveness as a tool for developing listening skills varies considerably, depending on how dictation exercises are constructed and implemented. This research examines some traditional dictation practices, identifies perceptual skills required to listen to music critically, and offers strategies for acquiring and integrating broader listening skills that will more directly develop students' critical listening and musicianship.

2.11 SCIENCE ACHIEVEMENT

Ahmad Basheer, Muhamad Hugerat, Naji Kortam (2017) conducted a study that the Effectiveness of Teachers' Use of Demonstrations for Enhancing Students' Understanding of and Attitudes to Learning the Oxidation-Reduction Concept. In this study we explored whether the use of teachers' demonstrations significantly improves students’ understanding of redox reactions compared with control group counterparts who were not exposed to the demonstrations. The sample consisted of 131 Israeli 8th graders in middle schools (junior high school). Students' attitudes and achievements as well as their understanding of redox and electrolysis were assessed by administering a questionnaire that investigated their attitudes (perceptions) towards a demonstration in chemistry. The findings showed that the
experimental group's achievements and understanding of the subject were statistically significantly better than those of their control group counterparts. The current study provided evidence that, if planned properly, demonstrations can serve as an effective platform for enhancing students’ understanding of certain chemistry concepts as well as increase their motivation and interest to learn chemistry. This study focused on the topics of oxidation-reduction and electrolysis; more key concepts should be researched in order to obtain a more comprehensive picture regarding the implementation of educationally effective demonstrations.

Aidoo, Benjamin; Boateng, Sampson Kwadwo; Kissi, Philip Siaw; Ofori, Isaac (2016) examined that Effect of Problem-Based Learning on Students’ Achievement in Chemistry. The study investigated the effect of problem-based learning (PBL) on students' achievement in chemistry. Learners' low achievement in Science in South Africa has been a concern to government, stakeholders, school principals and parents over the years as a result of poor teaching techniques, students' attitudes, lack of teaching and learning materials, teachers' pedagogical skills, etc. Several studies, for instance the Monitoring Learner Achievement (MLA) project conducted by UNESCO and UNICEF have shown no improvement in the performance of South African students in Mathematics and Science. Quasi-experimental design was employed for the study. 101 equivalent students were selected for the study using pre-test. The control group was taught with the traditional lecture method whiles the experimental group received instruction with PBL. Independent t-test was used for the analysis. Results showed that there was significant difference (p < 0.05) in chemistry achievement of students between control and the experimental group while there was no significant differences in the
before the study. The results show that PBL is an effective way for to teach chemistry so as to improve students' critical thinking and problem solving skills.

**Rani, K. V.(2015)** found that Relationship of Perceptual Learning Styles and Academic Achievement among High School Students. Perceptual Learning styles are different ways in which people process the information in the course of learning, intimately involved in producing more effective response stimuli. The objective of the study was to find out the correlation between the variables of Perceptual learning style in total and with its dimensions to Academic achievement. Population of the study includes all students studying in High Schools of Kanyakumari District. Samples of the study were 328 students who were studying in various High Schools located in Kanyakumari District. The tool adopted here was "The Learning Styles Scale" developed by the Investigator herself. Statistical techniques involved here were "t-test" and Pearson's Product Moment coefficient of correlation". The findings of the study revealed that, perceptual styles of learning were greater for Female and Tamil medium students than that of their counterparts. Also from correlation, it was revealed that, the perceptual learning styles have a high correlation with the academic achievement of students. So, educators need to recognize different modes of learning and had to adopt different approaches to teaching, that enable students to adopt different learning styles to learn effectively. This means that, teaching needs to be designed to include different learning opportunities and appropriate assessments to ensure that, the learning is accessible to the largest number of students. The teachers must be persons who are capable for applying a mix of teaching approaches to the classroom and in planning the learning opportunities for students which should benefit the maximum numbers of students, thereby develop our Mother India.
Muhammad Shabbir Ali1 & Muhammad Naeem Mohsin (2013) focus that Relationship of test anxiety with students’ achievement in science. This research was conducted to explore the relationship of secondary and higher secondary school students’ test anxiety and their achievement in the subjects of science i.e. Physics, Chemistry, Biology and Mathematics. Test Anxiety Inventory (TAI) was used to measure students’ test anxiety. Data was collected from a sample of 1,885 secondary school science students studying Physics, Chemistry, Biology, and Mathematics at 10th grade. Simple correlation (r) and standardized regression coefficients (β) were used to investigate the relationships between test anxiety and achievement in science. The results of the study indicated that test anxiety was significantly negative with total achievement scores of all the four science subjects. High test anxiety caused lower achievement scores. Similarly, the Test Anxiety had significant but negative relationship (p < 0.01) with Physics, Chemistry, Biology, and Mathematics achievement measure for simple correlation analysis.

William Bigge (2013) conducted a study on The Inactive Torch: A New Tool for the Science of Perception, The cognitive sciences are increasingly coming to terms with the embodied, embedded, extended, and experiential aspects of the mind. Exemplifying this shift, the enactive approach points to an essential role of goal-directed bodily activity in the generation of meaningful perceptual experience, i.e., sense-making. Here, building on recent insights into the transformative effects of practical tool-use, we make use of the enactive approach in order to provide a definition of an inactive interface in terms of augmented sense-making. We introduce such a custom-built interface, the Enactive Torch, and present a study of its experiential effects. The results demonstrate that the user experience is not adequately captured by any standard assumed perceptual modality; rather, it is a new
feeling that is mediated by the design of the device and shaped by the overall situation of the task. Taken together these findings show that there is much to be gained by synergies between engineering and the cognitive sciences in the creation of new experience-centered technology. We suggest that the guiding principle should be the design of interfaces that serve as a transparent medium for augmenting our natural skills of interaction with the world, instead of requiring conscious attention to the interface as an opaque object in the world.

Dayal and Indira (2013) conducted a study on the effects of scientific attitude of secondary school students to promote their science interest, study habits, cognitive style, academic achievement, scientific creativity, academic achievement motivation, delay of gratification, task persistence, science methodology, science achievement, socio-33 economic status, school environment and home environment. The result of the study showed that scientific attitude depended upon different factors viz. psychological, social and biographical. The results from the study suggested that the psychological variables were more consistently related to scientific attitude then the socio-biographic variables.

Deidra J. Young (2008) conducted a study on Rural and Urban Differences in Student Achievement in Science and Mathematics: A Multilevel Analysis Recent educational research has demonstrated rural/urban differences in achievement and success in higher education. However, in order to assess the rural school's impact on student outcomes, rural/urban comparisons must be made after accounting for student background variables. Researchers have begun to question the generalisability of the effective school model for urban, suburban, and rural schools, given substantial differences in their social and organizational environments (Hannaway & Talbert, 1993). The purpose of this research study was to examine
differences in student achievement between rural and urban schools in Western Australia, after controlling for student background variables. By using multilevel modeling techniques, this study demonstrated that the location of the school had a significant effect upon student achievement, with students attending rural schools not performing as well as students from urban schools.

**Fabio Alivernini (2007)** found that National Institute for the Educational Evaluation of Instruction and Training An Analysis of Factors Affecting Pupils’ Science Achievement in Italy. Background indices in the TIMSS 2007 data are complex variables referring to educational contexts which are presumed to affect students’ achievement in science subjects. The objective of this research is to examine, for the Italian 4th grade data, the relationships between these indices both at school and at pupil level and the proficiency scores for overall achievement in science subjects. A multilevel analysis was conducted adopting a four-stage procedure and considering the home/student level nested under the school/teacher level. The results showed that pupils’ performance in science subjects is significantly related to being a native student, to gender, to home educational resources, such as the number of books at home, to student self-confidence in learning science and to student perception of being safe at school.

**Saravana kumar and Mohan (2007)** conducted a study on enhancing the level of meta-cognitive orientation and attention and activation techniques towards enhancing student’s achievement in science. The result of the study revealed that gradual increase in the dependent variable namely, student’s achievement in science from initial assessment to final assessment indicates the influence of the independent variables viz, Meta cognitive orientation and attention activation strategies.
2.12 SYNTHESIS OF REVIEW

The investigator has reviewed a total of seventy five studies both Indian and Foreign. After critical evaluation of the studies related to perceptual skills like listening skills, aural skills, auditory skill, kinesthetic skills, visual skills and science achievement, the investigator has made the following conclusions.

Researcher reviewed studies on the development of perceptual skills through different skills in India and Abroad. Andrew William (2017) found that the development of perceptual training programmers and the identification of potential elite soccer players. Ebersole, Tela M.; Kelty-Stephen, Damian G. (2017) shows that students are ready and willing to engage in the study of S&P by setting aside neuroscience's sometimes constraining assumptions Broadbent DP1, Causer J1, Williams (2017) found that the cognitive effort explanation for the CI effect and propose an alternative hypothesis highlighting the role of error processing. Sattizahn, Jason R.; Lyons, Daniel J (2015) it is perceptually difficult to locate the CoG of objects with asymmetric-extended properties Song et al (2011) found that The study found that interindividual differences were strongly correlated between the two tasks for met cognitive ability but not objective performance A. M. Williams (2010) shows that the development of perceptual training programmers and the identification of potential elite soccer players. Savithiri (2006) found that The result of the study revealed that by using met cognitive strategies perceptual skills could be enhanced in learning Geometry. Bruno, Parameswaran & Beena, (2006) found that Perceptions are usually changing, biased, colored, or distorted by our unique set of experiences. Bonifacci, P. (2004) Results highlight a significant difference in visual-motor integration between children with high and low gross-motor abilities, in the absence of significant differences in perceptual skills or intellectual ability.
Paul Ward and A. Mark Williams (2003) shows that Implications for training perceptual and cognitive skill in sport are discussed. Perceptual learning effects in the visual system are highly specific for a variety of properties of the training stimulus, including its location.

Researcher reviewed studies on the development of visual skills in India and Abroad. Offerdahl, Erika G.; Arneson, Jessie B.; Byrne, Nicholas (2017) they demonstrate how our taxonomy can be used to analyze course assessments and spur discussions regarding the extent to which the development of visual literacy skills is supported by instruction within an undergraduate biochemistry curriculum. Çayir, Aybala (2017) students' visual perception skills should be supported for successful reading processes. Paek, Seungoh; Hoffman, Daniel L.; Black, John B. (2016) This study results show that changes in the sensory experience at the time of learning have a "bottom up" impact on learners' ability to process new content. LaDue, Nicole D.; Libarkin, Julie C.; Thomas, Stephen R. (2015) in their study identifies the representations which are most critical for training students across the science disciplines in anticipation of the implementation and eventual assessment of the NGSS. Dhanapal, Saroja; Kanapathy, Ravi; Mastan, Jamilah (2014) The findings in their also indicated that almost all teachers and students gave positive views for the integration of visual arts in science lessons. Xiangzhi Meng, Alice Cheng-Lai, Biao Zeng, John F. Stein and Xiaolin Zhou (2011) in their research, it is concluded that reading development in Chinese depends on a certain extent on the development of dynamic visual perception and its underlying neural pathway and that the impact of visual development can be specifically related to orthographic processing in reading Chinese. McKenna, et al., (2006) study required a sophisticated analysis of environmental factors, particularly in contexts in which factors are abstract, novel
and/or detailed or in circumstances where important visual information is obscured. Kenneth A. Kavale and Steven R. Forness (2000) found that auditory and visual perceptual skills can successfully increase the accuracy of predicting reading achievement, but the magnitude of the increases in predictive accuracy was contingent upon the combination of variables studied and was significantly reduced if an IQ score was known.

Researcher reviewed studies on the development of listening skills through different skills in India and Abroad. Cigerci, Fatih Mehmet; Gultekin, Mehmet (2017) found that digital stories, listening activities based on the stories, and the creation of a more engaging and motivating classroom environment had positive effects on listening comprehension skills in the experimental group Acat, M. Bahaddin; Demiral, Hilmi; Kaya, Mehmet Fatih (2016) found that the web based systems can be used positively for language learning, teaching, and instruction, improving, measuring and assessing process. Betty Preus, Rachel Payne, Carly Wick and Emily Glomski (2016) Findings of their research confirmed previous research suggesting the bi-directional nature of development, in which young people with significant developmental assets both contributed to the community and garnered additional assets as a result of their engagement. Solak, Ekrem; Altay, Firat (2014) their study revealed that participants used top-down processes effectively during the listening process, but they were not so good at using bottom-up processes. Wolvin, Andrew (2013) studied that we all vary in our ability to listen" an important reminder that a "one size fits all" model of the listening process may be a conceptual barrier to truly understanding what makes for successful listening. Rhoda Feldman (2002) research focuses on one of the themes that emerged in interviews and observations: the importance of personal connections to art.
Researcher reviewed studies on the development of Auditory skills through different skills in India and Abroad. Zaltz, Yael; Roth, Daphne Ari-Even; Kishon-Rabin, Liat (2017) studied that Children learned the difference limen for frequency task only when EF was provided. Sarro EC1, Sanes DH1 (2014) found across-age correlations for sensory and cognitive measures, obtained during development and in adulthood, depend heavily on the specific type of developmental experience and the outcome measure. Besken, Miri; Mulligan, Neil W. (2014) in their study, results are in accord with the perceptual fluency hypothesis and show that this metamemory illusion is related to objective measures of perceptual difficulty Gregg, Melissa K.; Samuel, Arthur G. (2012) Their results support a distinction between auditory objects and streams, and provide new information about the way that the auditory world is parsed Kuppen, Sarah; Huss, Martina; Fosker, Tim; Fegan, Natasha; Goswami, Usha (2011) studied Poor auditory processing was not dependent on low IQ, as auditory processing was age appropriate in the low-IQ children who were good readers. Micheyl, Christophe; Hunter, Cynthia; Oxenham, Andrew J. (2010) in their research the results showed that, although ear separation could facilitate perceptual segregation and impair asynchrony detection, it did not prevent the perceptual integration of simultaneous sounds.

Researcher reviewed studies on the development of Kinesthetic skills through different skills in India and Abroad. Whitworth, Brooke A.; Chiu, Jennifer L.; Bell, Randy L. (2014) In their research, they described the approach to inquiry used and an explanation of kinesthetic investigations in general Bonwell, Charles C. and James A. Einson (2006) found out that To make learning English is effective for elementary school students, the teacher needs to consider active learning as one strategy to teach English to elementary school students who are kinesthetic learners.
Kuan-yi LiabWei-jen SucHsuan-wei Fud Kristen A.Pickette (2015) their findings suggested that individual with DCD lag behind their TD counterparts in kinesthetic sensitivity. Jody L. Kerchner (2000) study indicated that the kinesthetic mode of response best captured children's linear thinking patterns. Warren Haston (2010) showed that Teaching with an aural/modeling emphasis does not hamper participants' music performance skills, and may aid them. Nancy M. Gamso (2011) . This research is a report on the project and a description of its implementation and assessment. Dana Ferris (1998) their findings showed statistically significant differences in the students' responses across several contextual and student demographic variables. Michael J. Kendal (1988) found that the introduction of music reading activities did not impede the development of students' aural and instrumental performance skills. Stephen C. Larsen and Floyd G. Hudson (1973) The results of their study lend support to the motor theory of speech perception, which posits that accurate interpretation of speech involves not only an adequate auditory system but also feedback from the speaker's own articulator movements.

2.13 RESEARCH GAP

The investigator himself thoroughly analyzed the related review of literature of present investigation both India and aboard between the period of 2000 to 2017. The following classification were made while synthesizing the review of related literature in perceptual skills such as listening skills, aural skill, kinesthetic skill, visual skill, haptic skill and science achievement
In the overall sixty seven of previous research studies were analyzed based upon the inference. The investigator identified many of the studies were very close to the present investigation and there were limited studies in perceptual skills among students in science. In this preview the investigator has identified the research gap in the area of perceptual skills. In order to fulfill the identified research gap the investigator has chosen the topic entitled “Developing perceptual skills to enhance students’ achievement in science at high school level” right now.

The next chapter deals with the methodology of the study.