INTRODUCTION

The purpose of teaching is to prepare the learner for life by imparting the necessary knowledge and skills. Learner needs to be developed holistically to make a right use of the knowledge and skills. When the societies are degenerating with dominant material interest, increasing immortality and threatening violence teacher needs to be more alert to play his judicial role. Fear, anxiety, conflict, enmity are seeping into the classrooms. Hence the teacher has to promote every learner to feel the situation to think independently, critically, and even creatively, to take right decisions and solve his problems. At this stage of human evolution self awareness develops self discipline with a matured balance of emotions.

One of the major challenges in teaching in any discipline is to meet the needs of a variety of students. When it comes to teaching science it has been shown that more traditional methods of textbook and lecture instruction are not always the best way to teach. An instructional design is valuable in science if the design promote the construction and reconstruction of knowledge.

The construction of deep scientific knowledge results from actively practicing science in structured learning environments. Learning environments should support student’s active construction of knowledge. Teachers should employ teaching strategies that help learners recognize conflicts and inconsistencies in their thinking, as these experiences catalyze the construction of new, more coherent knowledge. Modern learning theory describes learning as an active, internal process of constructing new
understandings. In order make learning meaningful the learner should study the materials by himself. To successfully understand the task, student needs tools to monitor and evaluate learning process. Effective tools in the self learning process can be student by himself. Students can use his/her self questioning abilities to regulate, evaluate, and reflect to learn the task thoroughly. Learner can also use technology, media and text as a tool to regulate, evaluate and reflect on his learning. This idea of controlling own thinking processes and becoming more conscious of our learning is called **Metacognition**, it is a buzzword in teacher education.

Metacognition refers to our knowledge of what we know (or what we know about what we know) and the use of this knowledge to direct further learning activities. When engage in critical thinking, students need to monitor their thinking process, check whether progress being made toward an appropriate goal, ensure accuracy, and make decisions about the use of time and mental effort. Students can become better thinkers and learners by developing the habit of monitoring their understanding and judging the quality of their learning.

In re conceptualized curriculum, critical reflection as the recurring theme in all critical thinking activities is inherently Metacognitive in nature. Metacognition involves knowing how to tackle learning tasks, how to assess one’s own performance, how to ask for help and how to develop new knowledge out of the information given. Numerous studies have found that good learners and thinkers engage more cognitive activities than poor learners and thinkers.

The skills and attitudes of Metacognition can be taught and learned so that students can direct their own learning strategies and make judgments about how much
effort to allocate to a cognitive task. Hence in the present study the investigator decided to prepare a Learning Package based on Metacognition and its effect in enhancing the attainment of Metacognitive Skills in addition to achievement in biology.

In order to prepare the students for self learning and evaluation the investigator intended to prepare a Learning Package based on Metacognitive process and testing their efficiency in enhancing Metacognitive Skills in addition to achievement.

NEED AND SIGNIFICANCE OF THE STUDY

Knowledge can be efficiently gained by self directed learning. It is basically a shift from known to unknown. The problem that all educators invariably encounter in teaching different subject at different grade levels of our educational system is how to teach a lesson to a class that consists of students with different skills, learning pace and learning styles. Another challenge in education is to make learning more effective, interesting, and exciting and time consuming. Education becomes meaningful only when it creates better learners in the present to make better performance in future.

Who is a better learner or better performer? “

Knowing how to learn, knowing which strategies work best are the skills that differentiates expert learners from novice learners’. To make a learner expert in learning we, the teachers should help him to regulate his /her learning, Educators are always concerned about what educational methods can benefit the learners the most
Educators and psychologist highlighted the necessity for caring for the learner’s individual differences and learning styles because they represent the foundation upon which instructors should build their instructional methods. So as a facilitator or stage setter teacher should make the learner independent in acquisition of knowledge and its internalization.

In order to build knowledge and wisdom the learner needs to be intrigued by the material presented. The way in which the learner reads, studies and perceives the information presented and can add to his Metacognition. Thus Metacognitive Skills or Metacognition determines whether the learner is a novice learner or an expert learner. Metacognition or awareness of learning is a critical ingredient to successful learning. Once a person has learned his strategies for learning he can go from being a novice learner to an expert.

Now a day’s most of the educational views rotate around the concept that child can construct knowledge from his own experience. Each individual has his own needs, interest, capacities and requirements. To meet the different learner characteristics individualized instruction is an effective learning strategy. The goal of individualized instruction is to make learning self initiated and self directed to improve the construction and reconstruction of knowledge they should control their thinking process, they should possess knowledge about their cognitive structure. Instead of focusing on the content of the subjects, suggesting the means and ways of learning will be more helpful to the learners. As a facilitator teacher should help the learner to recognize their own cognition or to make him aware about the Metacognitive Skills.
The teacher’s task is to determine the student’s level of cognitive awareness and Metacognitive strategies that help to achieve goals. This will make the learners to become self dependent and goal directed achievers. Metacognitive strategies are sequential process that is used to control cognitive activities and to ensure that a goal has been met. So in the present study investigator intended to prepare a Learning Package in Biology by integrating Metacognitive strategies for enhancing Metacognitive Skills among the learner.

OBJECTIVES OF THE STUDY

1. To prepare a Learning Package based on Metacognitive Process.

1. To prepare and standardize a Metacognitive Assessment Scale (MAS)

2. To test the effect of Learning Package based on Metacognitive Process in enhancing Metacognitive Skills.

3. To find out the level of achievement of students when existing Activity Oriented Method of Instruction is used in teaching Biology at secondary level.

4. To find out the level of achievement of students when Learning Package based on Metacognitive Process is used in teaching biology at secondary level.

5. To compare the effectiveness of Learning Package based on Metacognitive Process with that of the existing Activity Oriented Method of Instruction on the total achievement in biology of secondary school students.
6. To compare the effectiveness of Learning Package based on Metacognitive Process with the existing Activity Oriented Method of Instruction on Attitude towards Science of secondary school students.

7. To compare the effectiveness of Learning Package based on Metacognitive Process with the existing Activity Oriented Method of Instruction on Science Interest of secondary school students.

METHODOLOGY

The major aim of the study is to develop a Learning package in Biology by integrating the process and skills of Metacognition at the secondary level and to find out the effect of this package in enhancing Metacognitive Skills and achievement in biology of the secondary school students. So the current research study was experimental in nature.

Experimental Design:-

In this study, the investigator has adopted the “Pre-test Post-test, Non equivalent group design”. The present study utilized two groups, the group which was exposed to the experimental treatment was the experimental group and the other which was exposed to Activity Oriented method was the control group and this permitted the comparison for the scientific investigation. The investigator in the present study made use of two non equivalent intact classroom groups, one experimental group and one control group. To compensate for the lack of equivalency between two groups, the investigator has applied the technique of Analysis of Co-variance. A pretest was
administered to the two groups at first. These groups were then randomly assigned to treatments. The experimental treatment was administered to experimental and the control group was treated with activity oriented method.

Then the post test was given to the two groups. The differences between the pretest and post test scores were compared with the help of appropriate statistical techniques to ascertain the relative effectiveness of Learning Package and Activity Oriented method.

**Sample selected for the study:**

The investigator adopted simple random sampling technique for the sample selection. 6 divisions of standard IX of 3 schools from 2 districts of Kerala were selected for the study. The total final sample consisted of 190 students from all the above three schools. 95 students were in each experimental and control groups.

**Variables in the Experiment :-**

Variables are the conditions or characteristics that the experimenter manipulates, controls or observes. A variable is some aspect of a testing condition that can change or take on different characteristics with different conditions. In the present study a Learning Package based on Metacognitive Process and Activity Oriented Method of Instruction” were the **independent variables. The dependent variables** were

- Achievement scores of experimental and control groups in Biology
- Metacognitive Skills
• Attitude towards Science

• Science Interest

**Tools and Materials used in the study:**

For the purpose of present study, the investigator prepared the following materials and tools.

• Learning Package based on Metacognitive Process (prepared by the investigator)

• Metacognitive Assessment Scale for secondary school students (prepared and standardized by the investigator)

• Scale of Attitude towards Science

• Science Interest Inventory

• Lesson transcripts and learning materials based on Activity Oriented Method (Prepared by the investigator)

• Achievement test in Biology (prepared and standardized by the investigator)

**RESULT AND CONCLUSION**

The major conclusions based on the statistical analysis of data, obtained from the comparison of Learning Package Based on Metacognitive Process and Activity Oriented Method of Instruction are comprehend below under the following subheads.
Learning Package based on Metacognitive Process is more effective than Activity Oriented Method of Instruction in enhancing metacognitive skills among secondary school students.

This conclusion is substantiated by the following findings of the study.

The mean post-test scores of experimental group that was taught through Learning Package Based on Metacognitive process is found to be higher than that of the control group which was taught through Activity Oriented Method of Instruction (M1= 89.60,M2 = 41.09). The critical ratio of mean values of post-test scores of experimental and control groups (CR= 21.187; p<0.01) indicates that the experimental group has significant improvement in the attainment of skills after the experiment. This vouchsafes the advantage of Learning Package Based on Metacognitive Process over Activity Oriented Method of Instruction.

The gain scores of the experimental and control groups, when subjected to the analysis of Critical Ratio (CR=25.80 ; P<0.01) shows that there is significant difference between their attainment of Metacognitive skills on the mean gain scores ( M1= 50.90 ; M2 = 5.05)This data testifies to the advantage of Learning Package Based on Metacognitive process over Activity Oriented Method of Instruction.

The analysis of covariance of pre-test scores and post-test scores of students in experimental and control groups shows that there is significant difference between the means of the post test scores of the two groups (FYX = 2116.87 ; P<0.01). This
implies that the experimental group excels control group on the attainment of metacognitive skills.

The ‘t’ value for the adjusted means of post test scores of experimental and control groups (‘t’ = 47.81 ; P<0.01) was found to be significant at 0.01 level. This indicates that the adjusted mean of the post test scores of the group taught through Learning Package Based on Metacognitive Process. The adjusted mean of the post test scores of Metacognitive skills of the experimental group is 88.83, which is significantly higher than that of the control group, whose adjusted mean of the post test score is 41.01. Thus the students of the group taught through Learning package Based on Metacognitive Process gained significantly higher scores than those taught through Activity Oriented Method of Instruction. This confirms the supremacy of Learning Package based on Metacognitive process over Activity Oriented Method of Instruction on enhancing Metacognitive skills among students at the secondary level.

**Learning Package Based on Metacognitive Process is more effective than Activity Oriented Method of Instruction on the total achievement in biology of secondary school students.**

The mean post test scores of experimental group that was taught through Learning Package Based on Metacognitive Process is found to be higher than that of the control group which was taught through Activity Oriented Method of Instruction (M1 = 31.25, M2 =14.35). The critical ratio of mean values of post test scores of experimental and control groups (CR= 22.127 ; P< 0.01) indicates that the experimental group has significant improvement in the achievement of biology after
the experiment. This vouchsafes the advantage of Learning Package based on Metacognitive process over Activity Oriented method of Instruction.

The gain scores of the experimental and control groups, when subjected to the analysis of Critical Ratio (CR = 23.85; P< 0.01) shows that there is significant difference between their achievement on the mean gain scores (M1 = 26.08, M2 = 5.033). This data testifies to the advantage of Learning Package Based on Metacognitive Process over Activity Oriented Method of Instruction.

The analysis of co-variance of pre-test and post-test scores of students in experimental and control groups shows that there is significant difference between the means of the post-test scores of the two groups (fYx = 754.42; P< 0.01). This implies that the experimental group excels control group on the achievement in biology.

The ‘t’ value for the adjusted means of post test scores of experimental and control groups (‘t’ = 16.86; p<0.01) was found to be significant at 0.01 level. This indicates that the adjusted mean of the post test scores of the group taught through Learning Package Based on Metacognitive Process. The adjusted mean of the post test scores of achievement of the experimental group is 31.22, which is significantly higher than that of the control group, whose adjusted mean of the post test score is 14.36. Thus the students of the experimental group taught through Learning Package Based on Metacognitive Process gained significantly higher scores than those taught through Activity Oriented Method of Instruction. This confirms the supremacy of Learning Package based on Metacognitive Process over Activity Oriented Method of Instruction on the total achievement in biology of secondary school students.
Learning Package Based on Metacognitive Process is more effective than Activity Oriented Method of Instruction in enhancing Science interest among secondary school students.

This conclusion is substantiated by the following findings of the study.

The mean post test scores of experimental group that was taught through Learning Package Based on Metacognitive Process is found to be higher than that of the control group which was taught through Activity Oriented Method of Instruction ($M_1=28.29$, $M_2=13.63$). The critical ratio of mean values of post test scores of experimental and control groups ($CR=24.88$; $P<0.01$) indicates that the experimental group has significant improvement in science interest after the experiment. This point out the advantage of Learning Package Based on Metacognitive Process over Activity Oriented Method of Instruction.

The analysis of co-variance of pre-test and post-test scores of students in experimental and control groups shows that there is significant difference between the means of the post-test scores of the two groups ($f_{Yx}=1038.83$; $P<0.01$). This implies that the science interest of experimental group is higher than that of control group.

The ‘t’ value for the adjusted means of post test scores of experimental and control groups (‘t’ = 32.43; $P<0.01$) was found to be significant at 0.01 level. This indicates that the adjusted mean of the post test scores of the group taught through Learning Package Based on Metacognitive Process. The adjusted mean of the post test
scores of science interest of the experimental group is 28.23, which is significantly higher than that of the control group, whose adjusted mean of the post test score is 13.63. Thus the students of the group taught through Learning Package based on Metacognitive Process gained significantly higher scores than those taught through Activity Oriented Method of Instruction. This confirms the supremacy of Learning Package based on Metacognitive Process over Activity Oriented Method of Instruction on enhancing science interest among students at the secondary level.

**Learning Package Based on Metacognitive Process is more effective than Activity Oriented Method of Instruction in enhancing attitude towards science among secondary school students.**

This conclusion is substantiated by the following findings of the study.

The mean post test scores of experimental group that was taught through Learning Package Based on Metacognitive Process is found to be higher than that of the control group which was taught through Activity Oriented Method of Instruction (M1 = 118.47, M2 = 87.29). The critical ratio of mean values of post test scores of experimental and control groups (CR = 21.187; P < 0.01) indicates that the experimental group has significant improvement in their attitude towards science after the experiment. This vouchsafes the advantage of Learning Package Based on Metacognitive Process over Activity Oriented Method of Instruction.

The analysis of co-variance of pre-test and post-test scores of students in experimental and control groups shows that there is significant difference between the
means of the post-test scores of the two groups (fYx = 358.49 ; P< 0.01). This implies that the attitude towards science of experimental group excels control group.

The ‘t’ value for the adjusted means of post test scores of experimental and control groups (‘t’ =19.09 ; P<0.01) was found to be significant at 0.01 level. This indicates that the adjusted mean of the post test scores of the group taught through Learning Package Based on Metacognitive Process. The adjusted mean of the post test scores of attitude towards science of the experimental group is 118.47, which is significantly higher than that of the control group, whose adjusted mean of the post test score is 87.29. Thus the students of the group taught through Learning Package Based on Metacognitive Process gained significantly higher scores than those taught through Activity Oriented Method of Instruction. This confirms the supremacy of Learning Package Based on Metacognitive Process over Activity Oriented Method of Instruction on enhancing attitude towards science among students at the secondary level.

Conclusions Based on Findings:-

1. Learning Package based on Metacognitive Process is more effective than Activity Oriented Method of Instruction in enhancing Metacognitive Skills among secondary school students.

2. Learning Package based on Metacognitive Process is more effective than Activity Oriented Method of Instruction on the total achievement in biology of secondary school students.
3. Learning Package based on Metacognitive Process is more effective than Activity Oriented Method of Instruction in enhancing Science Interest among secondary school students.

4. Learning Package based on Metacognitive process is more effective than Activity Oriented Instruction in enhancing Attitude towards Science of secondary school students.

**Educational Implications of the study**

1. The result of the study have proved that Learning Package Based on Metacognitive Process is more effective than Activity Oriented Method of Instruction on the achievement in biology of secondary school students. It is found that students enjoy learning through the package, so teachers should incorporate Metacognitive Packages in terms of techniques, methods and materials in the process of teaching learning.

2. From this study it is clear that individualized system of instruction help the students to attain scientific concepts at their own pace and Learning Package based on Metacognitive Process is a combination of variety of learning activities and learning materials. When the learner go through such a package he can plan, monitor and evaluate his own learning and could do necessary correction in his learning styles. By adopting such an approach in teaching-learning process, a teacher can make her student an expert learner.

3. The study revealed that Metacognitive training is effective in improving learning and performance outcomes. Hence while commencing the learning task, with
regard to its objectives, its nature and appropriate Metacognitive strategies’ necessary to master it. For that, the budding teachers as well as the teachers in service should be sensitized about the need for incorporating Metacognitive training in their teaching. Also the curriculum planners and the concerned authorities at DIET, SCERT and NCERT should seriously look in to this aspect—the need of the hour in the teaching learning process

4. Teachers should be given orientation as how to develop Learning packages based on Metacognitive Process, by making use of the locally available resources to teach biology both at school and college level. This will give a better preparedness to ensure optimum human resource development.

5. Keeping the results of the study in mind, the agencies to improve the quality of education should take up the task of developing Lesson packages based on Metacognitive Process for all the subjects.

REFERENCES
