CHAPTER II

CONCEPTUAL FRAMEWORK

2.1 Learning Strategy

2.2 Web Based Learning

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2.4 Astronomy Education
CONCEPTUAL FRAMEWORK

Conceptual framework is a visual or written product, one that “explains, either graphically or in narrative form, the main things to be studied—the key factors, concepts, or variables—and the presumed relationships among them” (Miles & Huberman, 1994). It helps the investigator to assess and refine the goals of research, to develop realistic and relevant research questions as well as to select appropriate methods. A researcher can build the conceptual framework from four major sources like, (a) experience, (b) prior theory and research, (c) pilot studies and (d) results of experiments similar to that of the problem under study.

Since the present study was intended to develop Web Based Meaningful Engaged Learning Strategy for learning Astronomy at Secondary school level, a detailed understanding of the concepts related to Web Based Learning, Meaningful Engaged Learning and Astronomy education is necessary.

2.1 Learning Strategy

From the time of birth or even from the womb itself an individual gets direct or indirect experiences from which he/she make some modifications in their behavior. All these changes which an individual undergoes during lifetime comprise the process of learning. To Smith (1962), Learning is the acquisition of new behavior or the strengthening of old behavior as a result of experience. It is a continuous process which extends from womb to tomb. It prepares a person to adjust and adapt himself with the ever changing world. In classroom context, learning refers to the change in behavior of students through certain planned activities and experiences provided by the teacher through classroom instructions in order to attain the predetermined goals of education.
In general, Strategy means a plan of action designed to achieve a particular goal. Learning strategies are strategies which help the learners to learn easily. It helps them to make learning more effective, to remember things better and to do tasks more effective and thereby enhance learning. Oxford (1990) says that learning strategies are specific actions taken by the learner to make learning easier, faster, more enjoyable, more self-directed, more effective and more transferable to new situations. Weinstein and Mayer (1986) have coined one definition of learning strategies as “behaviors and thoughts that a learner engages in during learning and that are intended to influence the learner’s process”. In essence, learning strategies are actions adopted by the learners to make learning more effective, easier, faster, fruitful, enjoyable, purposeful and goal oriented and thereby attain the goals of learning.

2.2 Web Based Learning

“For many years, visionaries and futurists have been telling us that one day we would have quick and easy online access to all of the world’s information. Well, the future has arrived; (it’s) called the World Wide Web (WWW) and its growth in the past few years have been phenomenal. Already the Web is showing us how global network will transform education”

- Kearsley (1996)

The emergence of web technologies has revolutionized the educational field. With its immense potentials, it can shift the traditional “Four Wall Classroom” to an “Any time, Any place, Anybody Classroom” environment. No local library may now compete with the web as an information source, at least regarding the quantity of information available (Esnault & Zeiliger, 2000). In education, the potential of World Wide Web can be utilized in two ways. Either it can be used as a tool to find and retrieve information which will supplement the classroom instruction or as an instructional media. The latter one is mostly used for distance education. In both these cases, a Website or a
number of Websites should be used for learning. This type of learning with the help of Web is known as Web Based Learning.

Web Based Learning seeks to conquer the barriers of time and space for students. It is learning in an open, flexible and collaborative system accessible anytime, anywhere and increasingly, on demand (Bailey, et al., 2000). Web Based instruction is a hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported (Khan, 1997).

Web Based Learning is based on a well built foundation laid by certain learning theories like Behaviorism (Skinner, 1976), Cognitive Constructivism and Social Constructivism. The behaviorist paradigm assumes the existence of objective knowledge independent of the learners whereas the cognitive and social constructivist paradigms view knowledge as a constructed entity made by each learner and group of learners through a learning process (Hadjerrouit, 2006).

2.2.1 Types of Web Based Learning

Web Based Learning can be mainly classified into two types namely,

(a) **Synchronous**: In Synchronous type of Web Based Learning, there is an online interaction between the teachers and the students by means of video conferencing/chating, audio conferencing etc. It is mainly an online mode of learning. The necessary condition is that, at the time of instruction, the teacher and the student must communicate online.

(b) **Asynchronous**: The Asynchronous type of Web Based Learning is an offline mode of Web Based Learning and can occur in two ways.

- The first type is Web supported/Web Based traditional classroom instruction in which the resources available on Web are used to support/supplement traditional classroom instruction.
Fig 2.1 Web Based Learning

Here, under the supervision of the teacher, students access web and the resources thus obtained are projected on a whiteboard during the class time itself. Also, the resources available on the internet are downloaded by the teacher and projected on the whiteboard during the class time. This type of Web Based learning is used in this study.

In this study, the investigator downloaded some softwares, videos, images related to Astronomy, available on the internet and are incorporated on a Website. This website is developed offline and stored in CD. The softwares, videos, and images are projected on the whiteboard during the class time.

- In the second type of Web Based Learning, the students can download the learning materials from the web and unpack it at their convenience. It can be conducted with or without the assistance of the teacher.

In all these cases, there should be one website or a number of websites to support learning. This is the most essential component of Web Based Learning.
In other type of classification of Web Based Learning given by Vetter & Severance (1997) Web Based Learning is classified into the following three types.

a. **Real time Web Based Learning**: Here a virtual classroom is created in which the teacher and a group of students meet at the same time through online. Many universities are now providing this type of online education.

b. **Non real time Web Based Learning**: In this type of Web Based Learning, students download the course from the web to a hard drive and take the instruction at his/her leisure.

c. **Combination approach to Web Based Learning**: In this approach of Web Based Learning, the course material is delivered on a CD-ROM with real time data streaming for the internet.

### 2.2.2 Dimensions of Web Based Learning

Web Based Learning is based on mainly 6 dimensions namely 1) Course Content Dimension 2) Learner Dimension 3) Legal and Ethical Dimension 4) Technical Dimension 5) Pedagogical Dimension 6) Usability Dimension.

![Fig 2.2 Dimensions of Web Based Learning](image)
1. Course Content Dimension

Course content is the key element of Web Based Learning as its nature provides the basis for selecting the method of instruction. It includes the subject information, its sub units, its scope, learning objectives to be satisfied etc. Educational experts and teachers decide the content to be selected.

2. Learner Dimension

This dimension refers to the characteristics of the learners that are to be taken into consideration while designing Web Based Learning. It includes the need, interest, age level, previous knowledge etc. of the learner.

3. Legal and Ethical Dimension

This dimension refers to the legal and ethical environment of Web Based Learning since any system is affected by legal constraints and ethical conventions, including copyright protection of knowledge producers, as well as security against knowledge manipulation and all forms of cheating (Graf, 2002).

4. Technical Dimension

It refers to the information technology infrastructure dimension, which relates to the hardware and software environment of Web Based learning. Web Based Learning systems run in a heterogeneous computing environment that includes multi-platforms, multi-browsers, multi-software and multimedia support (Hadjerrouit, 2006). So this dimension requires special attention from the part of Website designers and developers.

5. Pedagogical Dimension

It involves the pedagogical aspects of Web Based Learning. Web Based Learning is based on the learning theories like Behaviorism (Skinner, 1976), Cognitive Constructivism and Social Constructivism.
6. Usability Dimension

This is also an important dimension of Web Based Learning. The designed Web Based Learning material should be easy to implement, user centered and attractive to the learners. It must promote human interaction as well as human-computer interaction.

2.2.3 Features of Web Based Learning

Web Based Learning is not merely a learning based on a Website or any educational software available on web. It involves many complex tasks like analysis of the content, designing the material according to the need, interest and age level of the learner and implementation of the material with the help of educational experts and computer professionals. The main features of Web Based Learning are,

- Web Based Learning is based on the foundations of learning theories like Behaviorism (Skinner, 1976), Cognitive Constructivism and Social Constructivism. It is the way of implementing these learning theories for obtaining better learning outcomes. In Web Based Learning, the application of learning theories with the aid of technology is given more importance than merely using technology in learning.

- Web Based Learning is also a means of implementing learning. It can be used in distance learning where students can unpack the learning materials available on web beyond the barriers of time and space and learn it offline at their convenience. Another way is to use web as a medium for giving face to face interaction by means of online facilities like video conferencing, chatting, audio conferencing, email etc. Web Based Learning can also be used to supplement the traditional classroom learning by allowing access to web in the classroom under the direct supervision of the teacher.
Web Based Learning development is a combination of traditional software engineering, Web and multimedia engineering, pedagogical, esthetical, human-computer interaction, cultural and legal issues. Hence, the development process of Web Based Learning is inherently multidisciplinary (Marjanovic, 2005). It must rely on knowledge from different disciplines and stakeholders with different skills, such as teachers, learners, educational researchers, graphic experts, web administrators and web developers (Hadjerrouit, 2006).

Web Based Learning systems are actually living systems in the sense that they are subjected to changes in accordance with the changing needs of the learners, organization, technology, subject, pedagogy and legal as well as ethical issues. In constant changing environments, they must evolve rapidly in order to ensure the relevance, correctness and completeness of the content available online (Pahl, 2003).

The key features and additional features of Web Based Learning as given by Khan (1997) are given below.

Key features of Web Based Learning

Key features are inherent to the Web and are integral to Web Based Learning design. They are available for the designers to incorporate within Web Based Learning lessons. They are:

Interactive, Multimedia, Open System, Online Search, Device-Distance-Time Independent, Globally Accessible, Electronic Publishing, Uniformity World-Wide, Online Resources, Distributed, Cross-Cultural Interactive, Multiple Expertise, Industry Supported, Learner-Controlled etc.
Additional features

Additional features are dependent on the quality and sophistication of Web Based Learning design. The effectiveness of additional features largely depends on how well the key features are incorporated into the design of Web Based Learning. They include:

Convenient, Self-contained, Ease of use, Online support, Authentic, Course security, Environmentally friendly, Non-Discriminatory, Cost effective, Case of course work development and maintenance, Collaborative learning, Formal and Informal environments, Online evaluation etc.

2.2.4 Components of Web Based Learning

To Khan (1997), the components of Web Based Learning are clustered into the following general categories. They are,

1. Content Development

- Learning and instructional theories
- Instructional Design (ID)
- Curriculum development

2. Multimedia Components

- Text and graphics
- Audio Streaming (e.g., Real Audio)
- Video Streaming (e.g., Quick Time)
- Graphical User Interface (GUI- uses icons, graphics, windows and a pointing device (eg., Microsoft Windows, MacOS)
- Compression Technology (eg., Shock Wave)
3. Internet tools

a. Communication tools

✓ Asynchronous: e-mail, listservs, newsgroups etc

✓ Synchronous: Text based (eg., Chart, IRC, MUDs etc) and audio video (eg., Internet phone, Cu-See-Me etc.) conferencing tools

b. Remote access tools (logging into and transferring files from remote computers)

✓ Telnet, file transfer protocol (ftp) etc.

c. Internet Navigation tools (access to databases and web documents)

✓ Gopher, Lynx etc

d. Search and other tools

✓ Search engines

✓ Counter tool

4. Computers and Storage devices

✓ Computer platforms running Unix, DOS, Windows and Macintosh operating systems.

✓ Servers, hard drives, CD ROMs etc.

5. Connection and Services providers

✓ Modems

✓ Dial –in (eg., standard telephone line, ISDN, etc.) and dedicated (eg., 56 kbps, T1, E1 lines etc) services

✓ Gateway services provider, Internet services providers etc.
6. **Authoring Programs**

- Programming languages (e.g., HTML- Hyper Text Markup Language, VRML- Virtual Reality Modeling Language, Java, Scripting etc.)
- Authoring Tools (easier to use than programming languages)
- HTML Converters and Editors etc.

7. **Servers**

- HTTP servers, HTTPD software, web sites, URL-Uniform Resource Locator, etc.
- Common Gateway Interface (CGI) – a way of interacting with the http or Web services. CGI enables such things as image maps and fill - out forms to be run (http: //www. sp.ph.in.ac.uk/htmlinfo.html)

8. **Browsers and other applications**

- Text-based browser, graphical browser, VRML browser etc.
- Links (eg., hypertext links, hypermedia links, 3-D links, imagemaps, etc.)
- Applications that can be added to web browsers such as plug-ins

### 2.2.5 Validating the Information available on the Web

World Wide Web (also called WWW/W3 or simply Web) is a tool that helps to find and retrieve information, using links to other WWW pages. World Wide Web Consortium is the organization that maintains the standards that enables to use (and develop with) this terrific internet tool (Cady & Mc Gregor, 1996). But this World Wide Web Consortium has nothing to do with the authenticity of the data being posted through Web. There may be some
websites in which a person who is not an expert in a particular field has posted some information about that particular field. So utmost care should be there while selecting information from web as every person who links with the web owns a “Slice of the Internet”. November (2008) has given four steps for validating the information available on internet and are given below.

*Fig 2.3 Steps for validating the information available on Internet (November, 2008)*

**STEP 1 Check/Read the URL**

Whenever some data is accessed from any website, first of all check the URL (Uniform Resource Locator) of that Website. By analyzing the URL, some information about the Website, its publisher/owner and its relationship to other Websites can be known. For example, URLs with the extensions like .com,.org,.net etc. are owned by anybody. But the URLs with extensions .edu, .k12, .sch, .gov, etc. can only be obtained and used by educational and government organizations. If these extensions are not there, then keep reading past the first forward slash for more clues to see whether it is a personal page. For example, a name followed by tilde (~), percentage sign (%), the word users, people or members represents personal pages which may contain important information or links to important resources or helpful facts. Also
keep in mind that these may not be the biased opinions of the authors who posted it.

**STEP 2 Examine the Content**

As a book cannot be judged by merely inspecting its cover, similarly, a Website cannot be judged by the beautiful presentation of the topic. So check whether the information available is useful for the topic selected, the links given, does it works well, is the information accurate, updating of the information, any information which contradicts this was seen anywhere else etc.

**STEP 3 Check the Author & Owner**

Anybody can upload a document in the Web. This is an advantage as well as disadvantage of internet. The data may or may not be authentic. So before relying on it, the details about the author and owner, his/her qualification, expertise in the particular field, his/her address is provided or not should be checked. If there is no clue about the author, a website with URL www.easywhois.com which is a directory site that collects information from the internet to track who owns and who is responsible for a domain name can be used to check about the author or owner of the website. Another way is to chart the history of the website by visiting the way back machine at www.archive.org website. It is a digital library of websites from which an idea about the history of the website (i.e., whether any changes have been made throughout the years) which can shed light on the reliability of information on a particular site can be accessed.

**STEP 4 Check the Links**

While validating the information available in a website one should check whether the forward and backward links works properly. Forward links in a website may be the sites referred by the author before writing the particular page. If all the links provided by the author contains sites given by any
particular author, the information can be biased one. So its authenticity should be checked before adopting it. The number of authentic backward links reveals that the particular website contains valid data.

2.3 Meaningful Engaged Learning (MEL)

Meaningful Engaged Learning is a student centered learning strategy in which students are self regulated, intrinsically motivated, and heterogeneously as well as flexibly grouped in order to satisfy learning goals by solving authentic multidisciplinary tasks with the help of teachers, books and multimedia experiences. Through meaningfully engaging students in the learning tasks, learning will be more deepened. Curriculum, Technology and Education Reform (CTER) website states that Meaningful Engaged Learning is a student centered approach. It energizes students so they may have a lifelong passion to solve and understand problems. This approach allows students to take responsibility of their own learning. The teacher’s role is to create activities with certain specific curricular goals in mind. This strategy is based on the research of Dr. Mike Muir (2001), Director, Maine Center for Meaningful Engaged Learning at the University of Maine at Farmington, USA.

When children are engaged they are excited, curious and intensely involved in learning experiences that are meaningful to them (Jones et al., 1994). Also engagement increases the ability of the brain to remember; adrenaline created through emotional involvement activates the Amygdala, a part of the brain that decides which information is important enough to retain. Over time, a stronger and more lasting memory is created when the brain is emotionally involved (Mc Gaugh, 2003).

Weiman (2005) says that Meaningful engagement in learning Science means that students are actively thinking about the subject and applying scientific ideas to solve problems. To Bowen (2005), in Meaningful Engaged Learning, student’s engagement should take place in four different ways like
student engagement with (1) The learning process (2) The object of the study
(3) The contexts of the study and (4) The human condition.

2.3.1 Indicators of Meaningful Engaged Learning

In order to help educators to chart an instructional course and thereby maintain an orientation based on a vision of engaged learning, Jones et al. (1994) at North Central Regional Educational Laboratory (NCREL) developed some indicators of Meaningful Engaged Learning. They are as follows.

Fig 2.4 Indicators of Meaningful Engaged Learning

I Vision of learning

Vision of learning includes:

- **Responsible for Learning**: Here the students are self regulated and they are responsible for their own learning. By giving meaningful tasks they are asked to define the learning goals by themselves and find activities needed to solve these tasks.

- **Energized by Learning**: The students are intrinsically motivated for learning through the successful completion of tasks and not by
any rewards. This will create a lifelong passion in them for solving problems and learning concepts.

**Collaborative:** As through education, students should be trained to be responsible members of a society, students are asked to work in groups. This will create empathy for others and develop interaction skills in them.

### II Tasks

The tasks provided must be:

**Challenging:** Students must be given challenging tasks according to their interest and age level. It should be typically complex and must require some sustained amount of time to solve. Also, the tasks should develop thinking as well as social skills.

**Authentic:** The tasks provided should be authentic. It must be closely related to real world problem. Students should feel that they encounter with this problem in their daily life. Then only, they get interested in the task.

**Interdisciplinary:** Teacher should provide interdisciplinary tasks such that the students can correlate it with other subjects and thus create interest in them.

### III Assessment

The assessment should be:

**Performance Based:** The assessment should be based on the actual performance of the students in the classroom. By valuing the ideas generated by them during class, it can be done.
IV Learning Context

The learning context for Meaningful Engaged Learning should be:

* **Knowledge Building Learning Community:** The main aim of the learning groups formed must be to create a knowledge building learning environment rather than a fragmented, competitive group of students.

* **Empathetic:** The students in each group should consider the ideas of every member and the knowledge must be built on the strength of all members.

V Grouping

The students should be divided into groups prior to learning and the groups must be:

* **Heterogeneous:** It means that the group should include boys and girls of different cultures, learning styles, ability, socio-economic status and ages.

* **Flexible:** The teacher should be able to configure and reconfigure group members according to the purpose of instruction, common interest or needs of students etc.

VI Teacher Roles

The teacher must be a:

* **Facilitator:** The teacher should be able to give rich environments, experience, activities and authentic tasks to accelerate learning.

* **Guide:** The teacher should act as a ‘guide on the side’ rather than a ‘sage on the side’ and help students according on their needs.
The teacher should help the students to link new information with prior knowledge and give them additional information also.

**Co-learner and Co-investigator:** By participating with the students in various learning activities, the teacher will behave like a co-learner and co-investigator.

### VII Student Roles

Here the student takes the role of:

- **Explorer:** In order to solve tasks, the students discover concepts by applying different skills and interacting with the world, materials, technology etc. Thus the student takes the role of an explorer.

- **Cognitive Apprentice:** Students act as a cognitive apprentice by observing, applying and refining through practices which are used by the teacher while solving a task.

- **Producers of Knowledge:** By generating knowledge by themselves, through self-regulated activities, the students will become producers of knowledge.

### 2.3.2 Elements of Meaningful Engaged Learning

The four elements of Meaningful Engaged Learning given by Muir (2001) gives us an idea about how to make connections, how to motivate students, what kind of relationship should be established between teachers and students and what should be the learning style so as to make learning interesting and effective. These four elements of Meaningful Engaged Learning are depicted in the following figure.
Fig 2.5 Elements of Meaningful Engaged Learning

**Element 1: Meaning (Connections and Mental Frameworks)**

- **Connections:** Here the new learning is made to connect with what students have already learnt previously. As the tasks given are related to real life activities, students can easily relate it with their daily life and this will make their learning more interesting and enjoyable.
Conceptual Framework

- **Context**: The teacher has to provide real world works which the students have experienced in their daily life and that can be correlated with their life. Then only the learning will be meaningful.

**Element 2: Motivation (Why would I want to learn this?)**

- **Interest**: Students should be led by the novelty, mystery, curiosity and fantasy in the tasks. They should ask questions themselves and try to explore new ideas through discussions, experiments, modeling etc.

- **Autonomy**: As teacher provides tasks through various experiences, the students themselves identify the tasks and plan how to solve them. They have the autonomy to find the ways of solving the tasks.

- **Avoid Rewards**: Here the students are intrinsically motivated by the success in the tasks. No rewards are given on successful completion of tasks.

**Element 3: Experience (Patterns and Learning styles)**

- **Hands-on**: In this type of learning the students are exposed to hands-on activities, different types of real experiences etc. to benefit learning.

- **Learning Style**: The learning style should be such that it should give much importance to multiple intelligences. By grouping students into flexible heterogeneous groups students can be interchanged within groups according to the situations.

**Element 4: Environment (Relationship and Rapport)**

- **Student/Teacher Relationship**: A positive relationship which can build a physically and emotionally safe environment and sense of
belongingness and mutual respect between the teacher and the students should be established.

- **Helping students succeed:** The main role of the teacher is to help students to succeed in their tasks and thereby build their confidence in their abilities. For this teachers must understand the abilities of their students.

### 2.3.3 Focus Areas of Meaningful Engaged Learning

Muir (2010) says that schools working to improve student engagement and achievement should concentrate on balancing five focus areas as shown in the following figure.

![Five focus Areas of Meaningful Engaged Learning](image)

**Fig 2.6 Five focus Areas of Meaningful Engaged Learning**

Schools should consider the needs and interest of their students while framing the learning tasks and contexts. The tasks provided should have real world connections so that students should feel that they have encountered these problems in their daily life. Then only they can be motivated for learning. In order to solve tasks, direct experiences through experimentations, observations, discussions should be provided by the teachers. For exchanging more ideas and thereby enrich learning, discussions with students and teachers of other schools
must be entertained. This will increase interaction skills also. By engaging students with these experiences higher order thinking skills will be developed.

2.4 Astronomy Education

“I have loved the stars too fondly to be fearful of the night”

- Williams (1920) in her Poem, “The Old Astronomer to his Pupil”

Astronomy is said to be the oldest of Sciences. And we would not wonder, if that were true, for the objects of astronomical research have always shone in the sky above people (Kustaanheima, 1985). From ancient times itself, sky has been a fascination for mankind. They observed the Sun, the Moon, stars, comets and tried to study them deeply. Some people considered these astronomical objects as Gods and worshipped them. Meanwhile the beauty of the sky filled with Moon and dazzling stars colored the imagination of poets, painters, musicians etc. and provided inspiration for their art forms. The famous nursery rhyme, “Twinkle Twinkle little star” is an excellent example for this.

While analyzing the history it is evident that Astronomy is closely linked with the advancement of mankind. Astronomy prevailed in everyday life on the 15th and 16th centuries more than any other Science (Pannekoek, 1989). In the “History of Astronomy”, Hoskin (2006) says that we can be sure that in prehistoric times, the sky served the practical needs of at least two groups: navigators and farmers. Man depended on stars for his livelihood i.e., for agriculture, navigation, chronology, commerce etc. He knew how to orient using stars and how to determine co-ordinates of location. By this trade, cultural exchange as well as transmission of culture took place. Astronomy provided explanations for seasons and man used this information for agricultural purposes. Calendars based on the position of the Sun and Moon also provided evidence on the fact that these astronomical objects influenced
the life of common people also. It can even be said that early civilizations flourished on the basis of astronomical observations.

Astronomy has been the main part of the religious as well as philosophical conception of the world. During periods of great revolutions, the impact of Astronomy has been very strong. It has changed people’s conception of the whole universe. It is easy to claim that it feeds man’s imagination and raises his mind into the distant spheres, touches man’s divine nature and gives a feeling—and for many an experienced confidence—of the existence of God (Hannula, 2005). From all these it can be undoubtedly claimed that Astronomy stands out among all other subjects which has influenced the mankind.

2.4.1 Need for including Astronomy in School Curriculum

Astronomy learning is an integral part of School curriculum. Even though applications of Astronomy can be found in school subjects like Physics, Chemistry, Mathematics, Geography etc., it is mainly included in the Physics curriculum. Percy (2005) lists the reasons for including Astronomy in school curriculum. They are:

- Astronomy is deeply rooted in almost every culture, as a result of its practical applications and its philosophical implications. Among the scientific revolutions of history, Astronomy stands out. In the recent list of “the hundred most influential people of the millennium”, a handful of astronomers were also included. Astronomy has obvious practical applications to time keeping; calendars; daily, seasonal and long term changes in weather; navigation; the effect of solar radiation, tides and impact of asteroids and comets with the Earth.

- Astronomy is a forefront Science that has advanced the Physical Sciences in general by providing the ultimate physical laboratory—the Universe—in which scientists encounter environments far more extreme than anything on Earth. It has advanced the Geological Sciences by
providing examples of planets and moons in a variety of environments, with a variety of properties. Astronomical calculations have spurred the development of branches of Mathematics such as trigonometry, logarithms, and calculus and now they drive the development of computers.

Astronomy has led to other technological advances, such as low-noise radio receivers, detectors ranging from photographic emulsions to electronic cameras, and image processing techniques now used routinely in medicine, remote sensing etc. Its knowledge is essential as humankind continues to explore outer space. Astronomy, by its nature, requires observations from different latitudes and longitudes, and thus fosters international co-operation. It also requires observations over many years, decades, and centuries, thus linking generations and cultures of different times.

Astronomy reveals our cosmic roots, and our place in time and space. It deals with the origins of the universe, galaxies, stars, planets and the atoms and molecules of life—perhaps even life itself. It addresses one of the most fundamental questions of all - Are we alone in the Universe? Astronomy promotes environmental awareness, through images taken of our fragile planet from space, and through the realization that we may be alone in the Universe.

Astronomy reveals a Universe that is vast, varied, and beautiful—the beauty of the night sky, the spectacle of an eclipse, the excitement of a black hole. Astronomy thus illustrates the fact that Science has cultural as well as economic value. It has inspired artists and poets through the ages. Astronomy harnesses curiosity, imagination, and a sense of shared exploration and discovery. Astronomy provides an example of an alternative approach to “the scientific method”—observation, simulation, and theory, in contrast to the usual experiment and theory approach.
Astronomy, if properly taught, can promote rational thinking and an understanding of the nature of Science. Astronomy in the classroom can be used to illustrate many concepts of Physics, such as gravitation, light and spectra. Astronomy, by introducing students to the size and age of objects in the universe, gives them experience in thinking more abstractly about scales of time, distance, and size.

Astronomy is the ultimate interdisciplinary subject and “integrative approach” and “cross-curricular connections” are increasingly important concepts in modern school curriculum development. Astronomy attracts young people to Science and technology, and hence to careers in these fields. Astronomy can promote and increase public awareness, understanding and appreciation of Science and technology, among people of all ages. Astronomy is an enjoyable, inexpensive hobby for millions of people, whether they are serious amateur astronomers, armchair astronomers or causal sky gazers.

### 2.4.2 Difference between Astronomy, Astrophysics and Astrology

Astronomy is the study of the nature of celestial objects like stars, planets, comets, nebulae, asteroids, galaxies, satellites etc. and the various phenomena associated with these celestial objects. It includes the study of the whole universe and the objects beyond it. It deals with the evolution of earth, formation of stars, motion of celestial objects, the Physics and Chemistry behind every phenomena etc.

Astrophysics is the Physics oriented version of Astronomy. It includes the application of Physics to describe various astronomical observations and phenomena. It includes the physical laws, theories that are used to interpret the nature of the celestial objects, formation and development of the universe etc. Until nineteenth century, there was no distinction between Astronomy and Astrophysics.
Astrology is a belief that the relative position of the Sun, planets and Moon affect the destiny of humans. It is a faith system and is often used to determine the nature of a person’s personality or of certain circumstances in the future by means of horoscope. Scientists do not accept Astrology as a valid theory (Koupelis, 2011).

Conclusion

Web Based Learning offers huge opportunities for learning and the variety and scope of resources available on the web can be utilized by teachers to provide a seamless learning environment. It is the duty of the teacher to ensure that the learning environment provided should be in accordance with the needs of the learner. By adopting Meaningful engaged learning in classroom, students’ learning can be enhanced through authentic opportunities which in turn provide transformative experiences that support the pursuit of academic excellence.

An overview of the concepts related to Web Based Learning, Meaningful Engaged Learning and Astronomy education has helped the investigator to build a strong foundation for the development of Web Based Meaningful Engaged Learning Strategy for learning Astronomy at Secondary school level.