Chapter - 1
Introduction

1.1 Presentation Styles of E-Instruction and Issues

A learner’s native ability for learning and the style, with which the instructions are presented, will significantly influence the learning processes \((of\ higher\ education)\) [Felder et al 1988]. However, the influence referred here is for the teaching/learning process of classroom. Two major learning / instructional styles among others have been broadly identified by the authors. They are ‘active/reflective’ learning style and ‘active/passive’ teaching style. These two can be attributed to classroom teaching/learning processes. The ‘active’ style can be separately identified as one style from the other, in e-learning environment. The term ‘reflective’ is synonymously used in the place of ‘passive’ in the entire thesis through this operational definition. In any e-learning environment, the term ‘instructional-presentation’ may be considered in the place of ‘teaching/learning’. Important issues can be brought out from the above scenario through research questions.

Will both these styles create different influencing factors in e-learning scenario? From this question, the first hypothesis can be brought out.

**Hypothesis 1**: There will be a significant difference between the behaviour of learners, who possess either active or passive character, in their preference for learning style.

The learning process [Felder et al 1988] that are taking place within the learner \(\text{(considered e-learning environment as analogues to the classroom teaching/learning process)}\) under these two categorized styles, is presented in Figure 1.1. Apart from active and passive styles, other psychological and pedagogical aspects of learning processes are not considered for and by this research.
Another gross root level question: Can e-contents be designed under the styles of active or passive learning? If so, will such an effort be effective and reliable?

**Hypothesis 2:** There will be a significant difference between the instructional styles of these two characteristics, when an instructional material is created based on some standards and syntaxes.

Latest technology question: Can s/w agents be used to identify a particular characteristic learner whether (s)he adapts to a particular learning style and would probably welcome (or prefer for) that preferred stylish instructional materials?

**Hypothesis 3:** There will be a significant difference between the performance of e-learning systems that adapted s/w agents and those did not.

The above three hypothesis have brought out the crux of the research problem. Even though three basic hypothesis are presumed, the research work is primarily ‘question based’ deductive research and not ‘hypothesis based’ inductive research, even though social surveys are extensively employed.

![Figure 1.1 E-Content Instructional and E-Learner’s Learning Styles](image-url)
The information (or instruction) of the e-content is first received (or visualised) by the e-learner and (s)he (here onwards the third person pronoun namely ‘he/his’ will be used and it refers to both the genders alike) starts processing it through his mind. This is shown as first step in Figure 1.1. This processing could either bed one through passive learning or through active learning. The result of this process could either be able to comprehend/learned or unable to comprehend/not learned by the learner. This could have been processed through any one of the styles. Each one generally contradicts the other at least in three aspects shown in the Figure 1.1. The three distinctively different and delimited aspects are listed in Figure 1.1 as: memorisation or reasoning under inductive or deductive processes; Reflection or action after comprehension; and introspection or interaction with something, respectively of either passive or active learning processes.

According to plenty of available published literature (important and relevant ones are debated in Chapter-2), it is found that the technical and pedagogical areas are largely dealt with in isolation by most of the works. But the literature on issues pertaining to learning styles in congruent with certain technical aspects is rare to be seen [Keefe et al 1991]. Under this background, one of the delimited technical aspects of e-learning, namely, the role of s/w agents considered for the research will now be introduced.

1.2 Role of S/W Agents in E-Learning and Issues

S/w agents, by virtue of their definition and nature, autonomously deal with the required computational tasks for related user needs, while hiding themselves from the users. In other words the presence of agents in the system will not be known to the users [Nwana et al 1996], [Talukdar & Sarosh 1999]. A learner system that is assisted with s/w agents would help users, in providing relevant and aptly needed information of the content. Such information could be drawn from instructional documents such as books, library materials, database etc., so as to encourage learners, who are interacting with the learning system, to effectively participate in the learning process [Frasson et al 1997]. Mobile agents, through their
mobility, can overcome some of the problems of e-learning systems [Nwana et al 1996]. According to the author, “Agents increase the efficiency of the system, as traffic is reduced while they can pre-process the data locally”. It can analyse intelligently to decide which information can be sent. It is persistent as it can detach itself from the main process of the system that uses its services. Therefore agents will not be affected even if the system which originated them fails. In e-learning environments, it can act either as a user (e-learner) or as a service provider (server). Mobile agent paradigm when compared with client-server paradigm has outperformed in process oriented computational durations when they are plotted against number of nodes [Outtagarts et al 1999]. In addition, the bandwidth can also be saved by the latter when compared with the former, as it has to manage multiple networks. But reliability issues of mobile agents must be addressed before they are designed and deployed in any broad range of application areas [Chandreyee Chowdhury et al 2011].

Literature (Chapter-2) on mobile agents is aplenty, while that on the application of mobile agents, particularly in e-learning environment that caters to learner characters (delimited to active/passive learning) is very rare as per the knowledge of the researcher.

In view of the above indications, issues and backgrounds, the crux of the problem has been brought out clearly. With the support of related literature survey (Chapter-2), which was carried out by the researcher, three major research questions are brought out and stated explicitly below.

1.3 Major Research Questions

1. Which one shall improve the efficiency of agent based e-learning environment: A centralized single server based approach that originated agents? Or a decentralized approach that monitored mobile agents?
2. Can clustering of e-content objects according to learner characteristics be adopted for increasing the reliability of extracting reusable and sharable e-content objects?
3. Can learner characteristics be determined through mobile agent processing?
4. Can mobile agent based system will enhance the efficiency of the system?

From the above four major research questions, six major research objectives are extracted and presented below.

1.4 Major Research Objectives

1. To investigate the prospects of mobile agent in enhancing computational processing efficiency of e-learning system.
2. To determine whether intelligent mobile agents could be diploid so that apt e-learning objects could be generated for appropriate e-learner characteristics.
3. To derive quantifiable metrics as strategies for representing qualitative learner characteristics for the service of aglets.
4. To evolve an e-learning system framework that efficiently deploys intelligent mobile agents for effective e-learning.
5. To explore the probability technique for efficiently mobilizing agents for effective learning.
6. To draw conclusions from the research findings.

Limitations and delimitations are narrowed down from the crux of the problem (from the research questions, and the research objectives). For want of time (constraint) and space limitation of the thesis, the limitations are listed below in the scope of research.

1.5 Scope of Research

The research focuses on two interdisciplinary areas namely, e-learning instructional issues and issues related to computational processing by s/w agents. Two aspects of e-learning namely active and passive learning styles are delimited for the study. Case studies are limited to ‘Computer Science and Application’ e-learning instructional materials. These materials have been prepared by the researcher himself only to be used as case studies, and no originality in development of these is claimed by the researcher. The investigation studies of the research are limited to reliability of extraction of learner characteristics and
instructional materials by the s/w agents. The efficiency of the overall system will also be examined. But the research is not aiming for optimizing both these components. Experimental and social survey methodologies have been adopted for the studies. Strategies for the experiments were derived through social survey techniques, while the s/w agent processing has been experimentally studied in a closed environment with blade servers and nodes for servers, which were created under laboratory conditions. Efficiency was limited to retention time by the learners along with faded processing capacities of servers and not on energy efficiency. Four servers were considered with one single server dedicated for the agent origination and e-learning system, and the rest were meant for user nodes and for experiments with s/w agents. Experiments with agent mobility are considered under campus network conditions. Survey techniques were administered through control group of e-learners under purposive sampling technique. Software tools used for the research are: ASDK tool kit for agent processing, Java coding for pre-processor and SPSS 17.0 for statistical analysis.

1.6 Thesis Organization

Following this introductory chapter, the thesis contains five more chapters.

Chapter-2 deals with literature survey on the reports and findings of published papers (restricted to the scope of this research work) recognised by the scientific community. Conclusions and issues from the survey have been extracted and the research problems have been identified from the gaps found in the papers and presented in summary.

Chapter-3 elaborates the derivation of schema and strategies pertaining to active and passive learning characteristics. This chapter adopts social survey technique in bringing out qualitative and quantitative metrics for measuring the subjective learner characteristics. The metrics are represented in unit-less ratios of each strategy and quantified in terms of natural logarithmic function (boundary values) for the purpose of experimentations.
Chapter-4 presents the procedure and results of the first set of experiments which were conducted for investigating the learner characteristics using the metrics developed and presented in Chapter-3 by the s/w agents. For this purpose, a framework has been proposed in this chapter. This chapter also presents 14 samples of instructional materials as sharable content objects specially designed by the researcher for case studies.

Chapter-5 an important chapter, attempts to study the efficiency of the overall proposed system that adopted s/w agents. Second set of experiments which intended for validating the reliability of the s/w agents was carried out with a set of parameters.

Chapter-6 lists the findings, draws conclusions and makes recommendations brought out of the research studies. It also presents the scope for future research that could be in extended from this research work.

References of cited papers are listed along with a set of appendices on sample learning objects at the end of this thesis.