**Chapter Six**

**CONCLUSION**

This thesis presented a proposed University Management Information System (UMIS) and Learning Management System (LMS) components based on Service Oriented Architecture (SOA) that has achieved information system and pedagogical success based on the presented evaluation framework that utilizes information system, pedagogical, and managerial aspects of systems.

SOA as a design pattern addresses non functional requirements like interoperability and integration to achieve systems agility. SOA provides a fine granularity and modularity that solves many integration problems, but adds complexity to systems design. SOA is a design pattern that helped enterprises overcome integration obstacles, and gain agile and interoperable advantages within architectures. SOA utilizes Web services as main enabler to achieve addressed design goals.

Proposed LMS facilitates integration among different LMSs. An automated course search, import, and deposit process was presented. This automated process requires governance of business rules. Business rules might be limiting system efficiency, so they must be monitored and modified when needed. Manage business rules process was presented to achieve this goal. Utilizing SOA to integrate Web services and software agents in LMSs highlighted the unlimited advantages of Web services and its capabilities to facilitate software agents’ integration within systems. LMS should be thought of as a collection of stateless Web services. Pedagogical, social, and managerial advantages of added processes include:

* Overcome lack of internal courses
* Get use of external, higher pedagogical features courses
* Shareability among different educational institutions
* Competition increment adds to quality (indirect effect)
* Increase Return-On-Investment (ROI) by selling courses

Assessment is an integral part of the learning process, and a learning activity that can be achieved efficiently via mobile devices. Due to differences in mobile architectures, and as a result of lack of interoperability in current commercial LMS with external systems, mobile assessment may find difficulties in implementation. Interoperability between LMS and mobile mediator is achieved via adoption of Web services based SOA in LMS. Pedagogically, mobile assessment is important due to the assessment importance process to the learning process. Mobile assessment can facilitate and encourage students to attend assessments and enable distance education by expanding interactivity tools available to students to include mobile devices.

When more than software architecture satisfies information systems functional and nonfunctional requirements, performance is a key element of choosing the software architecture to be implemented. From the comparative analysis study of a three different Library Management System architectures: Parameterized Query, Stored Procedures, and Services based architectures, it was clear that neither network nor user-perceived performance were affected to the extent that limits the utilization and implementation of proposed SOA system, especially when compared to the non-functional requirements gained by adopting SOA, like integration and interoperability, compliance, security, maintainability, analyzability, decomposability and modularity, testability, portability via replaceability and scalability, simplicity, modifiability, and reusability.

Future work includes addressing more and widely system processes that rely on the presented SOA based LMS and the implemented Web services to address agility in education institutions. Business Process Management Systems that rely on proposed SOA based LMS and UMIS is the next step to take.