

# NEW PARADIGM FOR CLOUD COMPUTING CURRICULUM BY MEETING INDUSTRY NEEDS: CCSE AND EMC<sup>2</sup> AS CASE STUDY

Kawther Aldhlan and Mahreen Nasir

*University of Hail, Saudi Arabia*

---

**Abstract:** With the recent advances in technology and computing, it has become vital to update and revise the curriculum for Computer Science undergraduate students. The curriculum should meet the challenges and requirements of the industry by providing state of the art knowledge to the students. The main goal of any professional degree is to produce skilled graduates who can compete successfully in the job market. The traditional taught curriculum does fulfil the degree requirements, though it needs to be compatible with new industry trends as well. This paper is an attempt to highlight the importance of introducing new computing courses and certifications by having Academic Alliance between Educational Institutes and leading Industry partners. This is supported by discussing the Academic Alliance of College of Computer Science and Software Engineering (CCSE), University of Hail (UoH), with top leading industry partner like Egan Marino Corporation (EMC<sup>2</sup>). Various aspects of this alliance resulting in offering new elective course in the curriculum and as certified training course will be mentioned. Additionally, a survey was conducted to take students' feedback regarding such certified courses. The paper will discuss in detail the outcomes of the survey in addition to the results of the courses offered as part of this alliance

**Keywords:** Curriculum, Cloud Computing, Learning and Teaching, Higher Education

---

## I. Introduction

The field of Information technology is growing rapidly. This technological revolution has changed the way information can be processed, stored and used later for further analysis. It is the need of the hour to incorporate these new tech trends into undergraduate curriculum in order to equip students and make them aware of the recent advancements. As an example, the concept of "Cloud Computing" has become a norm in the industry. It has been widely used in academia and industry for various purposes. One of them being the storage of huge amounts of information. Since this paradigm is and will be the future need, it is necessary to make it part of professional degree programs. It is required that the course curriculum be designed in a way to address not only the theoretical concepts but also provide hands-on training to students to become familiar with the architecture and various phases of Cloud development and maintenance. This will facilitate the students in having the relevant practical experience to find a successful position in the job market. Keeping this vision in mind, College of Computer Science and Software Engineering, University of Hail, always seeks to bring excellence in education towards its students. This is achieved by signing Memorandum of Understanding (MOU) with high tech industry partner like Egan Marino Corporation (EMC<sup>2</sup>) to introduce "Cloud Infrastructure and Services(CIS)" as an elective course in the undergraduate curriculum. Besides this, a separate certification track is also offered to students.

The rest of the paper is organized as follows. Section II outlines the background. Details of Academic Alliance of University of Hail and offering of Cloud Infrastructure and Services course along with its results are mentioned in section III. Section IV outlines the students' view point based on the survey. Survey results are discussed in section V. The paper is concluded in section VI.

## II. Background

Producing skilled graduates should be the main target of any professional degree. To achieve this target the program curriculum must be outcomes based. Outcomes-based education has recently gained much attention to enhance the teaching

and learning process in various fields. According to (Butler,2004) Outcome based education (OBE) is a process of reshaping the curriculum, practices and evaluations to reflect high order learning achievements. So, the main aim is to increase the knowledge and develop skills by incorporating relevant changes. Additionally, as the main aim is to meet industry challenges while designing the curriculum is to consider the requirements of future stake holders. Keeping this idea the best approach for learning is to first specify what needs to be achieved. Once clear objectives (product or outcome) has been determined the policies, processes and methods can be put into place to achieve the goal.(Tuker,2004,Butler, 2004).

#### **A) EMC<sup>2</sup> Academic Alliance**

EMC<sup>2</sup>-An American multinational corporation which deals with providing services for storage of data, security of information, virtualization, cloud computing and other products in order to provide data storage ,management, analysis and protection to businesses. In order to fill the skill gap, **EMC<sup>2</sup>** is making alliance with universities which are offering accredited degree programs. The vision is to prepare students to meet future IT industry challenges in the field of cloud computing.

IT organizations of tomorrow will present many opportunities and challenges. IT professionals will be responsible for huge amounts of data from varying sources with diverse formats. There will be a need not only to construct and maintain the assets but also to provide services in order to facilitate business for their smooth operations. This requires strong implications for both traditional and emerging IT roles and skills. Academic Alliance programs will fulfil these future needs by offering open curriculum based education on many new technologies such as cloud management, big data, information storage, back up and recovery. The main focus is to deliver core principles and concepts independent of any vendor. This helps the students in developing high skills and market knowledge.

The universities in kingdom of Saudi Arabia are fully aware of the demanding future requirements and to meet them, various universities have signed (MOU) with EMC<sup>2</sup>. Table 1. shows the details.

### **III.University of Hail as Partner Institute**

University of Hail signed MOU with EMC<sup>2</sup>, in fall 2014. This alliance lead to the introduction of the course “Cloud Infrastructure and services (CIS)” as an elective course to under graduate students in college of Computer Science and Software Engineering. Also, certified short training course for CIS was also offered to students.

#### **A)Course Design**

The CIS course provides knowledge about the cloud infrastructure, service models, various deployment options and the key considerations while shifting towards cloud computing. The course focuses on in depth technologies which are needed to construct various environments including traditional, virtualized, and cloud data center environments. These technologies consist of implementing virtualization at compute, storage, networking, desktop and application levels. Additional insights are provided on topics as backup/recovery, business continuity, security and management. Students will study about the major requirements involved in migrating from classic data center to a cloud computing environment. At the end of the course, student’s will have sufficient knowledge for making required analysis about moving to cloud infrastructure and selecting the most suitable deployment option for their company or institution.

#### **B)Course Objectives and Aims**

Upon completion of this course, the student will learn about:

- Various transition phases while shifting to cloud from the classic data center.
- Virtualization technology at various levels including compute, storage, network, desktop and application layers
- Virtual Data Center’s business continuity solutions.
- Key characteristics, services, and deployment models of Cloud
- The Cloud infrastructure components and service management processes
- The Cloud security concerns and solutions
- Key considerations for migration to the Cloud

**C)Text Book**

1. EMC provided CIS Students Guide
2. Cloud Computing Bible, Barrie Sosinsky,2011,ISBN:978-0-470-90356-8 Wiley Publishing Inc.

**D)Learning Outcomes**

The students will be able to:

- Understand the main concepts, key technologies, strengths, and limitations of cloud computing.
- Identify the infrastructure and models of cloud including Software as a Service, Platform as a Service, Infrastructure as a Service, public, private and hybrid cloud.
- Discuss the main concepts in cloud security and privacy.
- Identify and analyze various problems and provide appropriate solutions.

**E)Laboratory Session**

To provide practical experience to students, lab sessions were also offered by using NDG access as provided by EMC<sup>2</sup>. To equip students with necessary skills, a separate lab is dedicated for EMC-CIS course in College of Computer Science & Software Engineering.

*Table 1. Universities in Saudi Arabia Having Alliance with EMC<sup>2</sup>*

Sr. No.	University	Region
1.	King Khalid University	Aseer
2.	King Fahad University of Petroleum & Minerals	Eastern
3.	King Abdul Aziz University	Makkah
4.	Umm ul Qura University	
5.	Taibah University	Madina
6.	Qassim University	Qassim
7.	University of hail	Hail
8.	Al Yamamh University	Riyadh
9.	Imam University	
10.	King Saud University	
11.	Prince Sultan University	
12.	Taif University	Taif
13.	King Abdullah University of Science and Technology	Western

**F)Certification Track**

Besides offering the course as an elective, a separate certification track was also offered, so that students who are unable to enroll in the course can still acquire updated knowledge by registering in the certification track.

**G)Results of the CCSE students**

The results of the students were very satisfactory among the past three years and showed excellent performance of students. Results are shown in Table 2. and Table 3. respectively along with graphs in Figure.1 and Figure.2.

*Table 2. Cloud Infrastructure & Services(CIS) Course Result*

Year/Semester	Pass %	Fail %
2014-15	81%	19%
2015-16	100%	0%
2016-17	100%	0%

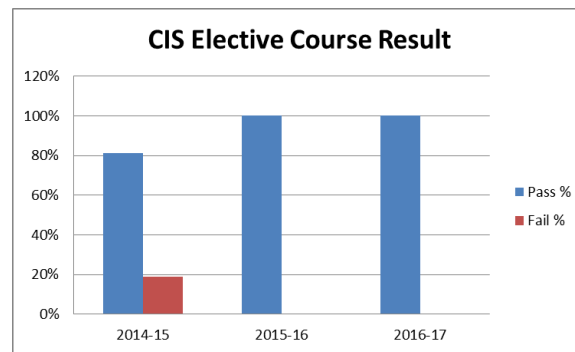


Figure. 1. Students’ Statistics in Cloud Infrastructure and Services Course

*Table 3. Cloud Infrastructure & Services EMC<sup>2</sup> Certification Exam Result*

Year/Semester	Pass %	Fail %
2014-15	79%	21%
2015-16	70%	30%
2016-17	92%	8%

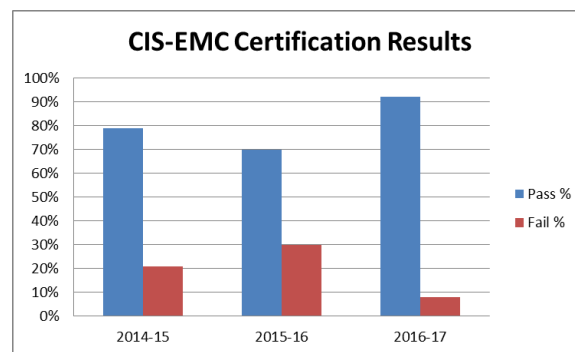


Figure. 2. Students’ Statistics in Cloud Infrastructure and Services Certification Exam

#### IV. Importance of the Academic Partnership from Students' Point of View

To assess the importance of the academic partnership from the students' point of view in CCSE at UoH, a survey was conducted among 480 undergraduate students from different programs representing the sophomore and senior students. The study was applied during first semester of 2016/2017. A total of 214 responses were received from participants via the blackboard. The survey was designed to have 14 questions including the demography part.

##### A) Results of the Study

The results of the study are illustrated in Figure 3, Figure 4, Figure 5 and Figure 6. The results were very encouraging and indicated that this partnership enhance the opportunities of getting good job, enriching the students technical skills in addition to preparing future industry professionals. Also, it is vital to mention the notable achievements of University of Hail that it ranked on top amongst all the partner institutions in the Kingdom in having the highest no. of enrolled students in CIS course and having the highest success rate of students consecutively for the years 2014-16.

#### V. Recommendations and Conclusions

To compete with new technology trends, it is recommended that more universities in the kingdom should introduce such advance level courses as part of their curriculum (Alamri *et al.*, 2013, Haleem *et al.*, 2013). It is suggested that both the faculty and students be equipped with the state of art industry knowledge. This will not only improve the standard of higher education in the kingdom but also serve to complement the skill gap. This paper attempted to highlight the growing importance of academic alliance between educational institutes and industry partners by incorporating advance courses like cloud computing in the curriculum. The example of introduction of cloud computing course at University of Hail in collaboration with EMC<sup>2</sup> was discussed along with the details about the course design, outcomes and taught modules. This was supported by providing results of the various batches of students which proved to be very successful. Additionally, the survey results clearly exhibited the strong demand and importance of these courses among the students.

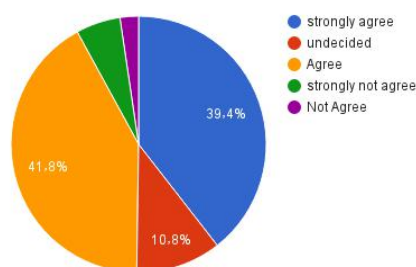


Figure.3. Passing an industry offered course help in getting good job

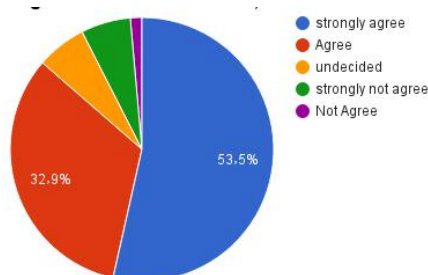


Figure. 4. University should have partnerships with Microsoft, Oracle etc

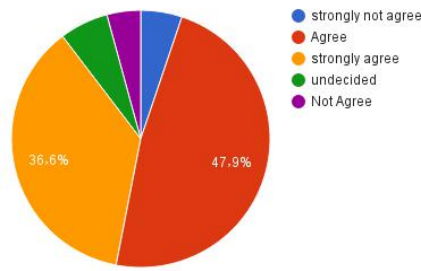


Figure.5. Certification Courses can improve students skills

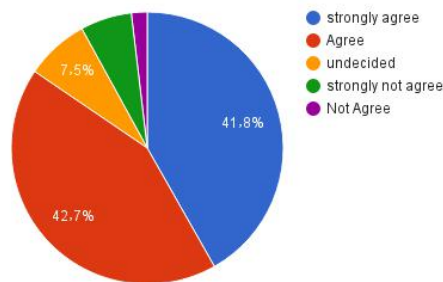


Figure.6. Such courses can prepare future industry professionals

## References

- Alamri, Bayan Hashr, and M. Rizwan Jameel Qureshi. "Usability of Cloud Computing to Improve Higher Education." (2015).
- A. Schwill, "Computer science education based on fundamental ideas," Samways, Brain (Hrsg.): Information Technology—Supporting change through teacher education. London: Chapman & Hall, pp. 285-291, 1997.
- Haleem, Muhammad, and Adnan Albar. "Towards Cloud Computing at IS Department, King Abdulaziz University." Middle Eastern & African Journal of Educational Research MAJER Issue: 4 (2013).
- Wong, Gary KW, and H. Y. Cheung. "Outcome-Based Teaching and Learning in Computer Science Education at Sub-degree Level." International Journal of Information and Education Technology 1.1 (2011): 40-46.
- Tucker, B. "Literature review: outcomes-focused education in universities." Learning Support Network, Curtin University of Technology (2004).
- Butler, Mollie. "Outcomes based/Outcomes focused education overview." Unpublished dissertation. University of Sydney, Sydney (2004).