Upskilling to Meet Cloud Talent Needs

Prof. Lawrence Eric Meyer Jr., Miami Dade College

Mr. Lawrence Eric Meyer is an Associate Professor Senior in thte School of Engineering and Technology at Miami Dade College (MDC). He has been working as the Co-PI on the Dade Enterprise Cloud Computing Initiative (DECCI) cloud grant providing cloud educational opportunities to high school and minority underserved populations. He assisted in the creation of MDC's current cloud curriculum and has been awarded a $600,000 ATE NSF grant to create an advanced cloud degree program for upskilling and reskilling the regional workforce. Holding AWS Solutions Architect and Developer certifications, along with Azure and Google cloud he is leading the effort into multi-cloud implementations for education in DevOps and Data Analytics.

Dr. Elodie Billionniere, Miami Dade College

Dr. Elodie Billionniere is an Associate Professor in the School of Engineering and Technology at Miami Dade College (MDC). She has helped MDC secure over $3 million in federal funding the past three years for STEM and emerging technology education programs as well as a collaborative high tech learning hub, Cloud Computing Center, with the aim of providing further opportunities to minoritized populations to meet workforce needs. With industry partners, she has been instrumental in the creation of new educational pathways in Enterprise Cloud Computing, which are unique in the state of Florida. She is the Lead Faculty for these programs. She holds several industry certifications, including PMP, ScrumMaster, AWS Certified Solutions Architect, and AWS Certified Big Data. She holds a Ph.D. in Computer Science from Arizona State University.

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Abstract

Miami Dade College, based on demands in the workforce, has focused on creating emerging technology education, particularly Cloud technology. Business Cloud migration has accelerated over the last several years, and companies around the world are investing in their future with the cloud. With the increased demand for cloud-skilled professionals the last four years, we launched a cloud literacy initiative to meet cloud talent needs. This initiative aims to provide our students in the computing/IT fields with the knowledge, abilities and skills needed to accelerate their cloud-related learning.

With the support of NSF ATE, we collaborated with Amazon Web Services (AWS) to create a new pathway for the next generation of cloud computing professionals. The course sequence was designed in conjunction with an AWS Educate team assisting in the design of course sequencing and degree plans to leverage their educational experience in teaching cloud technologies. The core curriculum designed for the cloud literacy initiative leveraged an existing pathway for an associate degree in networking technology, and then partially pulled classes from the design of the bachelor's in information systems technology degree. The classes identified, used current offerings across our programs and included a focus on the supporting infrastructure of cloud systems: Databases, Linux OS, and Networking. With these three foundational classes that were cloudified, three cloud-focused courses based on industry certifications were developed: Cloud Essentials for AWS Cloud Practitioner and Cloud Infrastructure and Services for AWS Solutions Architect certifications with a capstone class completing the academic pathway. This new curriculum includes pedagogical changes to utilize project-based learning by incorporating resources and learning from multiple sources to best mimic real-world application, data, and design attributes. In addition to the associate degree, a college credit certificate in cloud computing was created to strengthen (re-)entering students in the workforce and dual enrollment students with credentials and employability skills by using high impact educational practices.

Our cloud curriculum incorporates project-based learning approach, a real-world experience using the cloud technology. This poster shares strategies and pedagogical tools for teaching a cloud-focused curriculum for broader impact and student success.

Introduction

With the computing industry projected to grow much faster than other industries over the next 10 years, and as emerging technologies within computing-related fields such as cloud computing, many skilled jobs may go unfilled and business growth is threatened due to the shortage of trained professionals in these specializations [1]. For the past three consecutive years, cloud computing has been the most in-demand skill set companies are looking for when hiring [2]. The demand of these skills creates opportunities for educational institutions to partner with industry leaders to increase effectiveness in preparing students for a fast-changing future, which may not require a four-year degree anymore [3], [4] or may require upskilling/reskilling cloud certificates.

Background

To meet this growth, a cloud literacy initiative was created to develop an educational pathway in this high demand field. Specifically, we partnered with Amazon Web Services (AWS), the industry leader in cloud computing solutions, to increase the number of certified cloud computing professionals from underrepresented groups for workforce needs based on their two highest-paying AWS certifications, the AWS Cloud Practitioner and AWS Solutions Architect [5]. These certifications were deemed appropriate for entry-level students wanting to prepare for careers in cloud computing, and for experienced, working professionals who want to upskill, reskill, and prepare for cloud certification. Utilizing industry tested certifications, in addition to standard college grades, adds a level of recognition to program graduates to establish the competency of the student.

We collaborated with both AWS Educate and AWS Academy to develop and deploy appropriate cloud curriculum and instruction. AWS Educate is Amazon's global initiative to accelerate cloud-learning and prepare learners for the cloud-enabled jobs of tomorrow. AWS Academy helps close the skills gap by providing higher education institutions with free, ready-to-teach cloud computing curriculum equipping students with skills needed to pursue industry-recognized certifications and careers in the cloud [6], [7]. In short, AWS Educate provides a flexible and informal environment focusing on learning at one's own pace with digital badges whereas AWS Academy provides a formal and structured curriculum to accredited instructors to teach toward industry certification. The institution worked with both entities taking advantage of their unique benefits and expertise.

Cloud Competency-Driven Academic Pathways

Two of the goals during the curriculum development, included the expansion of options for students in a traditional associate degree pathway and the addition of the option for non-traditional students to upskill or reskill in cloud technologies. Stackable credentialing was deemed the most efficient route to accomplish this goal. We developed a College Credit Certificate (CCC) with core classes needed to prepare reskilling/upskilling students for entry level cloud jobs. The same classes are also added as a cloud concentration in the Networking Services Technology Associate in Science (AS).

During faculty training and course development, an issue arose concerning the large volume of assumed core cloud knowledge needed to be successful in passing the Solutions Architect certification exam. Fortunately, AWS released a new foundational certification, the AWS Cloud Practitioner. This certification covered core concepts in cloud computing and was accompanied with an industry certification. The splitting of the core concepts from the design concepts of the Solutions Architect made curriculum course development easier.

During course reviews both practical labs and project-based learning were determined to be a crucial aspect in learning and application of AWS cloud systems and concepts. The Solutions Architect certification exam tests participant knowledge through scenario-based questions requiring a complete understanding of how all the cloud technologies piece together. Practice

labs in AWS Educate and AWS academy coupled with project-based learning would be critical in helping students pass their certification.

Outcomes and Discussions

Curriculum Design
The result of these findings was three classes covering cloud core curriculum. These classes are the Cloud Essentials, Cloud Infrastructure and Services, and a project-based learning co-requisite capstone class paired with the cloud infrastructure class. These three classes with a three-course foundational class set form the classes required for the CCC and AS Cloud concentration (Table 1).

Table 1. Course listing for CCC / AS concentration

Course ID	Course Name	Certification
CGS 1540C	Database Concepts and Design	-
CTS 1111	Linux +	CompTIA Linux+
CTS 1134	Networking Technologies	CompTIA Network+
CTS 1145	Cloud Essentials *Co-requisite to CTS1134*	AWS Cloud Practitioner
CTS 2375C	Cloud Infrastructure and Services *Pre-requisite to CTS1145*	AWS Solutions Architect - Associate
CTS 2960	Cloud Computing Capstone *Co-requisite to CTS2375*	-

Digital Pedagogy
Pedagogically the use of labs, project-based learning and flipped classrooms were all supported by many tools and resources and were used for student success. The following tools were used to support the pedagogy:
1. *AWS Academy.* Educator portal that provides a ready-to-use curated curriculum, labs and resources targeting transitioning technicians to specific AWS Cloud Certifications. In order to use Academy resources faculty must be AWS-accredited instructors.
2. *AWS Educate.* System with access to virtually all AWS cloud resources in a simulated environment. Faculty request virtual classrooms and are able to deploy assignments and resources with low risk and no cost to the class.
3. *A Cloud Guru.* Premier multi cloud training group that provides lectures, labs and current events, to earn a variety of certifications.
4. *Whizlabs.* System that provides training and practice certification tests for individual and corporate use.
5. *On-Demand AWS Tech Talks.* These tech talks highlight various parts of AWS infrastructure, case studies, implementation discussions and more to expand the basic knowledge of AWS services and resources.

AWS Academy labs, examples and use cases provided, give the faculty and students a structured AWS set of tools and materials to cover the basics needed for certification. Combining AWS Academy with Whizlabs and A Cloud Guru lectures and tools, allows for differentiated instructions and viewpoints on certification basics. They all offer the opportunity for flipped

classrooms, allowing faculty to focus on practice and reviews, with core lectures, and practice performed before limited class time. All these tools together provide faculty an enhanced learning environment with lecture, self-paced practice, and hands on activities as needed to promote student engagement and success.

AWS Educate provides a risk-free cloud based sandboxed lab environment for classes to use. This lab environment access allowed for the foundational classes to lift and shift the databases, network designs and Linux environments into the cloud. This introduction to cloud allows a soft introduction to cloud tools, techniques for utilization and deployment of what used to be desktop environments into the cloud. A side effect of this lift and shift is the reduction in local software and hardware support needed for these environments. It also provides faculty an easy way to develop additional labs and exercises to bring more to the classroom than what is traditionally available due to limited hardware and software. This utilization of cloud components in the foundation classes simplified the introduction of students to later cloud class curriculum.

The decision to include project-based learning was affirmed through both faculty/student surveys and certification results. Seven faculty members participated in a 90-minute virtual focus group and indicated:

> *PBL affords students the opportunity for real-world problem solving as they learn.* Faculty observed that when using PBL, they work to ensure practical application, saying "it's real world, real problems, and real solutions to problems, based on getting them involved." Another faculty member noted, "I use it to bring more real-life examples to connect with the class, so the students can see how this knowledge is applied in the real world. PBL is an excellent tool to practice what [students] are learning." They explained that it is hard for the students at the beginning since "they don't know how to solve this right away," but the more they get involved with it, the more they improve. As one faculty member summarized, "We're passing agency to the student, to learn how to solve the problems."

Conclusion

AWS Academy course materials are geared toward college students and current technicians learning the cloud environment. The majority of the students enroll in this certificate in conjunction with their associate or bachelor's program in the computing/IT field. Although the COVID-19 pandemic interrupted for some of them their learning, the program success has been exceptional. Current AWS course material continues to adapt to changing certification updates keeping the curriculum up to date with AWS standards.

The success of project-based learning, real world course design and credentialing is demonstrated by the results. As of March 2021, our cloud literacy program in less than two years (launched Fall 2019) has certified a total of 111 AWS Cloud Practitioners, of which 21 were high school students, and 37 Solutions Architects including 10 high school students.

Acknowledgements

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