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Keeping Higher Education Aligned with the Requirements and Expectations of the Knowledge-Based Economy

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Abstract
Paper describes the procedure for developing academic programs which are properly aligned to the requirements of the knowledge-based economy. The paper also addresses the continuous quality improvement (CQI) process with the CQI loop closing on the program level and the course level. This process is needed to make continuous adjustments to an academic program, so that the program is always aligned to the constantly-changing needs of the economy. Paper also discusses the system of mutual dependency between the academic program and external partnership like local industry, secondary schools, local government, local community, regional business incubator center, other educational institutions, alumni and industrial advisory council. The ongoing collaboration with external partners allows the program to prosper and grow.

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1. Terminology

Program Educational Objectives
Jobs and the responsibilities that the graduates will have a few years after graduation. The program educational objectives are aligned to the positions for which the graduates being prepared.

Student Outcomes
A body of total knowledge and skills that graduates will have on the day of graduation.

Ecosystem of an Academic Program
The system of mutual dependency which is beneficial to all sides involved. The word "ecosystem" was borrowed from biology because it describes very precisely the concept of mutual dependency.

2. Introduction

Higher education, especially majors like Engineering, Business or Business Management, prepare graduates for leadership positions in the modern knowledge-based economy. The expectations of the knowledge-based economy are changing rapidly. Academic programs are part of an **ecosystem** in our society. This ecosystem can be compared to the ecosystem in nature, that is when one species provides the nutrients and conditions for other species to survive. Even though, this is sometimes a predator-prey relationship, the ecosystem is important. Sometimes, it is healthy for the ecosystem to eliminate the weaker trees, so that the strong ones have more nutrients to develop quicker. Similar rules also apply to the economy, especially a knowledge-based economy. Institutions of higher education are part of that ecosystem and cannot survive in isolation (Ulewicz, 2014).

3. Academic Programs as a Component of an Ecosystem

3.1. Academic Programs – Industry Ecosystem

The main partner of a university ecosystem is industry/economy. A university needs industry to provide employment for its graduates as well as internship opportunities for students and research opportunities for the faculty. Industry needs the university to provide a steady flow of qualified workforce who can adapt very quickly to the demand of the workplace without a lot of additional training. For this to happen, **the educational objectives** of the academic programs need to be developed by industry and should reflect not only the present needs of industry, but also the predicated needs of industry three to four years ahead. The program educational objectives are normally defined as the jobs that graduates will have a few years after graduation.

Program educational objectives are constantly changing. Program educational objectives need to be revisited and revised once every three years. This needs to be done by industry in cooperation with the academic program leaders. Revisiting and revising program educational objectives on a three-year cycle allows the program to remain aligned to the demands of industry (Nitkiewicz and Ayen, 2018).

A similar procedure needs to be followed when developing new academic programs. Step one is always the process of developing educational objectives. As previously mentioned, this step needs to reflect the present and future needs of the economy. This needs to be done by the industry partners who understand the needs and expectations of industry (Fig. 1).

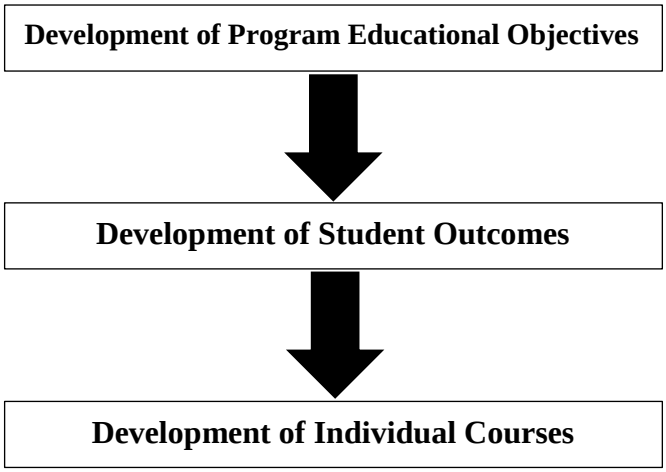

Fig. 1. Procedure for curriculum development for Engineering program

Examples of program educational objectives for an engineering program are as follows (Aldowaisan and Allahverdi, 2016; Sundaram, 2015):

- Be employed in public or private sectors in fields such as design, research and development, experimentation and testing, manufacturing and technical sales.
- Demonstrate a level of competence and expertise that may lead to an increasing level of responsibility and leadership within their respective organizations.
- Communicate effectively and work collaboratively in multidisciplinary and multicultural work environments.
- Recognize and grow an appreciation of the global, environmental, social and ethical context of their work.
- Be committed to lifelong learning to enhance their careers and provide flexibility in responding to changing social and technical environments which will enable graduates to pursue advanced degrees.

Based on the program educational objectives, the program faculty needs to develop **student outcomes**. Students outcomes are defined as a body knowledge and skills which are possessed at the time of graduation. These student outcomes need to be developed based on program educational objectives. Meeting the student outcomes at the time of graduation will allow the graduates to meet the program educational objectives (Alves et al., 2010).

Examples of student outcomes for an engineering program are as follows:

- an ability to apply knowledge of mathematics, science and engineering;
- an ability to design and conduct experiments as well as analyze and interpret data;
- an ability to design a system, component or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health, safety, manufacturability and sustainability;
- an ability to function on multidisciplinary teams;
- an ability to identify, formulate and solve engineering problems;
- an understanding of professional and ethical responsibility;
- an ability to communicate effectively;
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and social context;
- a knowledge of contemporary issues;
- an ability to use the techniques, skills and modern engineering tools necessary for engineering practice;
- an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

After the student outcomes are developed and clearly defined, the program faculty can develop the content of individual courses. These individual courses in the curriculum need to be mapped to the student outcomes. Every individual course needs to contribute to meeting the student outcomes. If a course is not contributing to meeting the student outcomes, it should be eliminated and replaced by a course contributing to meeting the student outcomes (Cave et al., 2000)

This applies to new programs as well as **continuous quality improvement** (CQI) for existing programs. The continuous quality improvement procedure as shown in Fig. 2 and Fig. 3 is essentially keeping the academic program constantly adjusted to the needs of the economy. Fig. 2 illustrates the CQI procedure for the academic curriculum (Mahbub, 2017).

Both CQI procedures for the curriculum of an academic program as well as the individual courses of the academic program are helpful and needed. Some academic programs which have drifted too far and do not correspond to the needs of the economy would need to be closed, so that the resources can be reassigned to a new program which is responsive to the needs of the economy and industry. The concept of rescuing outdated programs can be compared to the concept of trying to save every tree in the forest. As previously stated, it is better for the forest if the weaker trees get eliminated, so that the healthier ones have room to grow. This is how a healthy ecosystem should work, so that the economy and society are benefitted (Kahloun and Ghannouchi, 2017; Zhang et al., 2015; Ng, 2015).

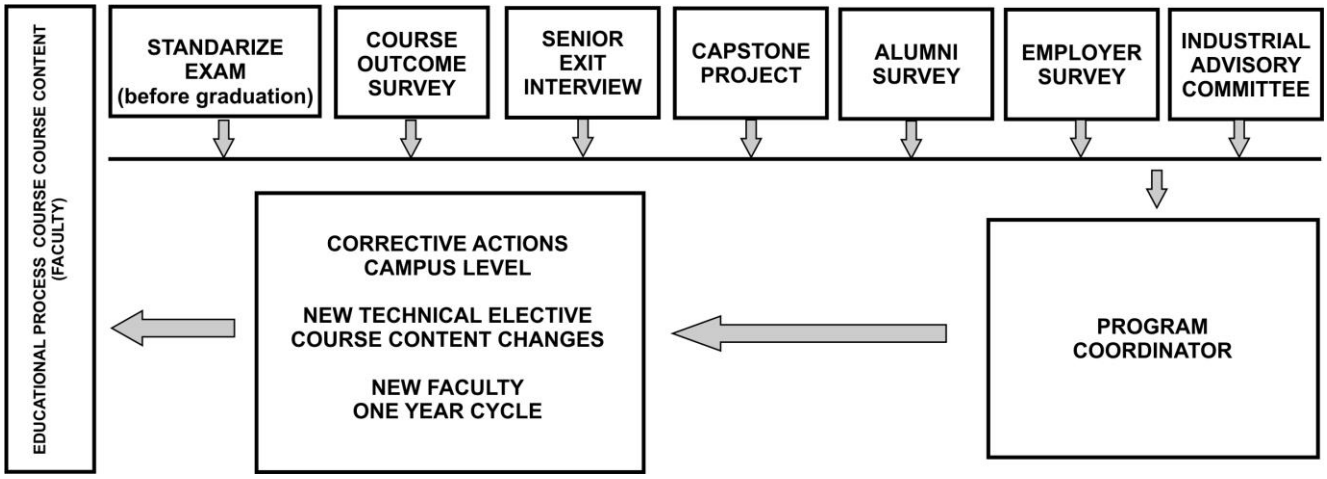

Fig. 2. Flowchart of the annual program assessment

Fig. 3 illustrates the CQI procedure for individual courses.

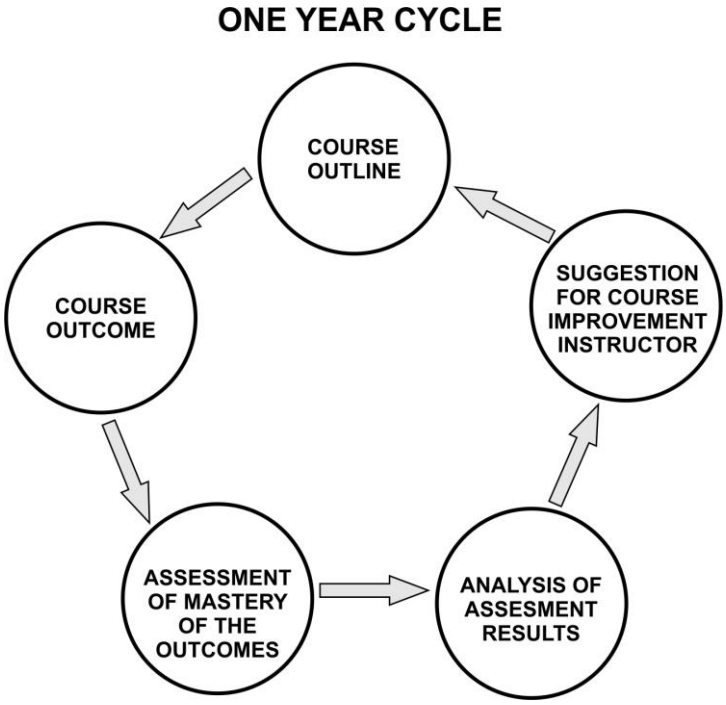

Fig. 3. Flowchart of the semester course review

Academic Programs – Secondary Education Ecosystem

Co-operation with local school districts and welcoming them into the ecosystem is extremely important from the perspective of recruiting well-prepared students into post-secondary programs. Secondary schools rely on academic programs to offer extracurricular enrichment activities for secondary students. University faculty is expected to offer in-service training courses for teachers and be guest speakers in some of the classes. Academic programs rely on secondary schools to provide well-prepared future students to the university.

Academic Programs – Local Government Ecosystem

The local government has an interest in promoting the economic growth of an area as well as promoting workforce development. Very often there are funding opportunities for workforce development. Welcoming government agencies into the ecosystem of an academic program can significantly benefit the program. Government agencies can become a valuable partner of the ecosystem. Government agencies should not have any authority in approving or disapproving the curriculum because government agencies do not have the necessary information and background related to curricular issues. Allowing government agencies to have the authority to

approve or disapprove the curriculum would significantly slow down required curricular adjustments.

Academic Programs – Local Community Ecosystem

The local community can be an important part of the ecosystem for an academic program. Building an awareness in the local community can be a very effective method for promoting a program and recruiting future students. Organizing a community day as an annual or biannual event can be an effective method to highlight the university's programs. This event can be an excellent way to showcase students' projects.

Academic Programs - Regional Business Incubator Center Ecosystem

The cooperation between academic programs and a regional business incubator center can be a unique opportunity to enhance the students' educational experience. The business incubator center could be used as a "teaching laboratory" and "learning factory". The clients of the business incubator center can become role models for college students from the perspective of innovativeness and creativity. The cooperation with a business incubator center creates opportunities to engage college students in real world problem solving. This would be difficult to accomplish in the classroom. Establishing the cooperation between academic programs and a business incubator center is not a difficult task, but it requires initiative on the part of the academic program.

Academic Programs - International Cooperation Ecosystem

No academic program can stay on the cutting edge of technology without international cooperation. International cooperation allows for student and faculty exchange as well as joint research projects. In today's global society, it is very important to provide students with the multinational and multicultural aspects of education. International cooperation allows for sharing the best practices and for providing the students with the skills for working as a part of diverse multinational and multicultural teams. International cooperation allows the best practices used by different countries to be shared. It also teaches the students skills to function, so that they will function well in multicultural and multinational teams. This is very important to promote the culture of tolerance and appreciation for diversity. A multinational and multicultural society is more flexible and resilient. The United States for a very long time had utilized a multicultural diverse workforce as a great asset for economic development. It has been proven that multicultural engineering teams are more creative and innovative because they have different perspectives in viewing the problem. International cooperation is an important component of the ecosystem for any academic program.

Academic Programs – Alumni Relations Ecosystem

Alumni are an important part of the ecosystem for any academic program. They can be a major asset to an academic program. Maintaining contact with alumni and an annual alumni reunion can be rewarding and beneficial to any academic program. During that time, senior-level students can be presenting capstone design projects to the alumni. Alumni can be very helpful in providing career guidance to graduating students. Alumni can also assist graduating students in finding employment opportunities. Very often alumni can provide ideas for student projects. Some alumni can be instrumental in facilitating the donation of laboratory equipment by industry.

Academic Programs – Other Educational Institutions Ecosystem

Other educational institutions like local community colleges can be very valuable partners to an ecosystem. They can be a source of transfer students. Articulation agreements between other institutions and community colleges can significantly help to increase the enrollment in any academic program. Those articulation agreements can focus on the transferability of credits between educational institutions in the ecosystem.

Academic Programs – Industrial Advisory Council Ecosystem

An Industrial Advisory Council (IAC) is a committee comprised of leaders from local industry. An IAC represents prospective and future employers for graduates of academic programs. The role of the Industrial Advisory Council is to provide feedback from industry through the continuous quality improvement (CQI) assessment of the program. An Industrial Advisory Council can be required to meet at least once every semester. The IAC can review the curriculum and suggest adjustment to comply with the expectations of industry. An Industrial Advisory Council can also conduct interviews with graduating students for collecting their perspective on the quality of their education and their satisfaction with the program. The IAC can provide the Program Director with the graduates' feedback and can contribute to the continuous quality improvement process.

4. Conclusion

In a free-market economy, every business must adapt to changing consumer needs. Academic programs are not an exception. Future students will be looking for academic programs which will prepare them for well-paying jobs in industry. Academic programs not leading to successful employment will have problems with recruiting students. It takes ongoing efforts on behalf of the faculty and university leaders to remain aligned with the expectations of the knowledge-based economy. Those expectations are changing rapidly. Academic programs need to keep up with those changes. If changes within the institution take place slower than changes outside the institution, it may mean the beginning of the end for the institution.

I would like to finish with this anecdote… "Every morning in Africa, a gazelle wakes up, it knows it must outrun the fastest lion or it will be killed. Every morning in Africa, a lion wakes up. It knows it must run faster than the slowest gazelle, or it will starve. It doesn't matter whether you're the lion or a gazelle-when the sun comes up, you'd better be running." (Christopher McDougall, Born to Run).

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保持高等教育与知识经济的要求和期望保持一致

關鍵詞

课程发展
质量改进
学术课程

摘要

论文描述了制定符合知识经济要求的学术课程的程序。 本文还讨论了 CQI 循环在程序级和课程级关闭时的持续质量改进（CQI）过程。 需要这个过程来对学术计划进行持续调整，以使该计划始终与经济不断变化的需求保持一致。 论文还讨论了学术课程与外部合作关系之间的相互依赖制度，如当地工业，中学，地方政府，当地社区，区域企业孵化中心，其他教育机构，校友和工业咨询委员会。 与外部合作伙伴的持续合作使该计划得以繁荣发展。