Using an Outcome Based Model to Foster Learning in Information Systems

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Abstract

In this paper, we introduce a new concept for developing and assessing an Information Systems Academic Model. This new Academic Model is based on learning outcomes as well as on grade point average. University and College specific learning outcomes form the basis of the Information Systems Curriculum. These outcomes are derived from the college's vision of the knowledge and skills that students need to acquire in order to be successful in gaining employment. Special courses are used to support and assist students in their understanding of the learning outcomes. Furthermore, we show how the use of technology can facilitate the learning and assessment process. Students develop an electronic portfolio to document and reflect on their learning experiences. Assessment and feedback are used to make the learning outcomes component work effectively in the students' learning experiences. This new academic model may help address issues on curricular design for successful career placement, and producing graduates with the skills and abilities needed for the job market.

1. Introduction

A college degree has in many ways become what a high school diploma was a 100 years ago: the path to a successful career and knowledgeable citizenship. Universities in the USA and worldwide are taking a critical look at their educational systems. A recent US national panel report calls for a dramatic reorganization of undergraduate education to ensure that all college aspirants receive not just access to college, but an education of lasting value. The panel offers a new vision that will promote the kind of learning students need to meet emerging challenges in the work place and in an interconnected world. The panel proposes a series of specific actions to raise substantially the quality of student learning in college. The report also recommends colleges to help students become "intentional" life long learners, and to create new assessments that require students to apply their learning to the real world[1].

Currently colleges and universities are facing a number of problems, including ill designed curricula that do not address the demands from the job market. There is also tremendous pressure from society to provide an education that results in "guaranteed" job placement and a degree worth the price. Furthermore, a number of academic institutions are facing the problem of grade inflation[2, 3, 4], which result in the GPA loosing its value. Employers are looking at alternative ways to assess graduate potential without focusing on GPA. Therefore colleges and universities are looking for alternative ways to provide an education that attracts students in a highly competitive arena.

A number of academic institutions in the US have moved to an outcome-based education framework to move away from the grade point average driven system. Accreditations institutions (such as North Central Association) are asking academic institutions to present a method to assess students learning outcomes in the general education courses. For example, In Columbia College, Columbia, Missouri, assessment of the student learning outcomes in the Information Literacy course is done by giving them a pre-test and a post-test. During the first day of the course, students are given a multiple-choice test about computer literacy. The same test is given to the students during the last week of the course as part of their final examination. The difference between the two grades is used as a measure of their progress. Furthermore, college faculties across the US are beginning to adopt new practices that raise the level of student effort and achievement. The report's Web site[1] highlights many such promising innovations. The key to successful reform is a clear focus on the kinds of learning that students need for a complex world. The panel urges an invigorated and practical liberal education as the most empowering form of learning for the twenty-first century. It makes strong recommendations about the knowledge and capacities all students should acquire—regardless of backgrounds, fields, or chosen higher education institutions.

In this paper we introduce a new academic program model that is outcome-based and also grade point average (GPA) based. We show how assessment is effectively used to make the learning outcomes component work. We also show how the technology component can facilitate the learning and assessment processes. Finally, we describe how learning outcomes are used in the development of an information systems curriculum

2. Overview of Outcome Based Education

Outcome-based education is a method of teaching that focuses on what students can actually do after they are taught. All curriculum and teaching decisions are made based on how best to facilitate the desired outcome. This leads to a planning process that is different from the traditional educational planning. The desired outcome is first identified and the curriculum is created to support the intended outcome[5, 6].

There is no single authoritative model for Outcome-Based Education (OBE). Frameworks for OBE share an emphasis on systems-level change; observable, measurable outcomes; and the belief that given time all students can learn. The shift toward OBE is a result of educational institutions' worries about the current education system[7]. There is a belief in the academic world that the classic "input" educational system can not adequately prepare students for life and work in the twenty first century. Consequently, educators and policy makers are attempting to modify the way to measure the effectiveness of education. There is a need to shift from the emphasis on traditional inputs (such as course credits earned and hours spent in class) to learning outcomes[8].

Learning outcomes are to be clear, observable demonstrations of student learning that occur after a significant set of learning experiences. They are not values, attitudes, feelings, beliefs, activities, assignments, goals, or grades, as many people tend to believe. Typically, these demonstrations or performances reflect three things: (1) what the student knows; (2) what the student can actually do with what she knows; and (3) the student's confidence and motivation in demonstrating what she knows[6, 9, 10].
Proponents of the OBE in education agree that even though there are many ways to arrive at the

same results, what is important is that students achieve the defined outcomes. Opponents worry about why and how outcomes are selected and how students and schools are held accountable for achieving these outcomes. Both sides raise critical points on the structure and direction of the education system and the primary role of education in the community. There is some fear by educators that OBE takes away the freedom that teachers have in decision making pertaining to course content, course delivery, and assessment. The fear of losing control of their courses has created a phobia of OBE[11, 12, 13].

3. The University Academic Program Model

Universities in the Middle East and North Africa are still using the classical educational system. However, Zayed University (UAE) educators and administrators agreed that it is virtually impossible for a person to master a discipline or professional field without an emphasis on "Lifelong Learning" rather than simply acquiring knowledge. For this reason, Zayed University has adopted an educational framework that uses both learning outcomes and GPA in its academic model.

The university requires all of its students to own a laptop computer and all classrooms are wired to allow up to twenty network connections. At about a10-1 student-teacher ratio, the class size is quite small at Zayed University and allows instructors to dedicate more time for each student. Furthermore, instructional technology is widely used in the university and students use the electronic mail and the Internet on a daily basis. All of the above components offer the optimal conditions to generate an atmosphere to facilitate student learning.

The new Learning Outcome Academic model was developed to focus on the process of learning and was designed to help students develop critical intellectual capacities and skills. This academic model is a hybrid approach that uses learning outcomes as a basis to measure the learning process and uses grades to accommodate the classic academic system, which is the main system used in the region. The ZU Academic Program Model (APM) was developed to address challenges that face a rapidly changing society such as the UAE. The Academic Program was designed to help graduates face a complex and challenging world[13].

The APM was developed as a pedagogical and curricular framework to support student achievement of the university goals and to enhance the ability of faculty to give students clear guidance in the learning process. The APM is based on three sets of learning outcomes both within and outside of the college majors. These outcomes are identified for lifelong learning and continued student progress. The APM is a unique educational framework that draws on resources from the learning communities. Learning communities are made of faculty, students, and researchers from within and outside of the university. The learning communities are actively involved in shaping the APM to make sure it addresses the needs of the country. Finally, a national advisory committee with members being from local government institutions and private organizations provides input on what skills are needed for students to be potentially employed upon graduation. Figure 1 shows the components that support the APM for a successful implementation.

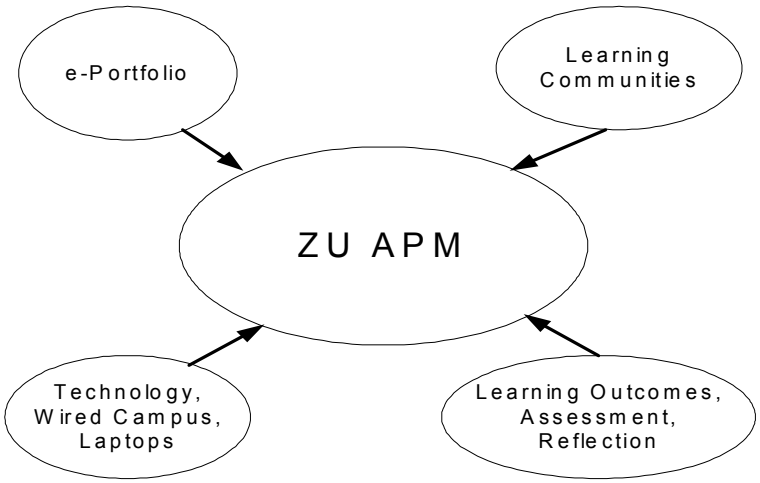

Fig.1. Components of the Zayed University Academic Program Model

3.1 Components of the Academic Program Model

The APM is framed by three sets of learning outcomes:

- The General Education Learning Outcomes (GELO)
- The Major Learning Outcomes (MaLO)
- The ZU Learning Outcomes (ZULO)

The GELOs and MALOs are course embedded learning outcomes, and the ZULOs are a set of higher intellectual outcomes, which can be achieved at different levels of the students' learning experiences. The GELOs are designed to help students develop an understanding of and the ability to apply the theoretical structures and methodologies of the academic disciplines. There are five GELOs: Creative Expression; Culture and Society; Humanities; Language and Communication; and Science, Mathematics and Technology. GELOs specify what students should be able to achieve by studying the subjects in a specific knowledge domain. For example studying in Science, Mathematics and Technology domain should enable the student to comprehend and apply the scientific method as a tool for thinking and seeking knowledge.

The Major Learning Outcomes (MaLOs) are designed to help students develop academic and professional competencies necessary to function effectively and independently as a scholar and practitioner in a selected field. MaLOs are developed in the respective colleges. The College of Information Systems (CIS), for example, has established five MaLOs that complement the learning outcomes of the Academic program model. The MaLOs, listed in section 4.1, form the basis for analysis and assessment that play an essential role in the continuous process of improvement.

ZULOs, which form the framework for the APM, are designed to help students develop higher order intellectual abilities needed for lifelong learning and success. All students must demonstrate accomplishments in the following ZULOs before they graduate:

1. Critical Thinking and Reasoning
2. Information Literacy and Communication
3. Information Technology
4. Global Awareness
5. Teamwork
6. Leadership

4. The College of Information Systems

The College of Information Systems is popular among students. The academic program of the College of Information Systems is practical, competency based, and designed to expose students to real-world problems through internship opportunities with various businesses and industries of the United Arab Emirates.

The Information Systems curriculum provides the opportunity for students to learn about a number of topics:

- Fundamentals of computer programming, data analysis and networking
- Database concepts, applications and design
- Information systems analysis, design and implementation
- The development of Internet business sites and electronic commerce
- The role of information systems in business and government
- The role of information technology in local and global societies

4.1 The IS Outcome-Based Educational Model

The College of Information Systems has established five Learning Outcomes that complement the learning outcomes of the APM. These Learning Outcomes form the basis for analysis and assessment that play an essential role in the continuous process of improvement. The Major Learning Outcomes for the College of Information Systems are as follows:

- Technical Communications: IS graduates will organize, develop, present, and evaluate technical material.
- Problem Identification and Analysis: IS graduates will be able to recognize, define, and classify problems.
- Problem Solving: IS graduates will derive solutions and evaluate their success.
- Information Technologies and their Applications: IS graduates will understand the capabilities, use, and application of information technologies.
- Systems Principles and Practices: IS graduates will demonstrate understanding of system types, structures, standards, and metrics.

The College of Information Systems MALOs and the university's learning outcomes form the basis of the IS curriculum and serve as a focus for curricular design in all aspects. As such, all course syllabi have to explicitly identify the course contribution to the learning outcomes (MALOs and ZULOs). Figure 2 shows how learning outcomes form the basis in all curricula development.

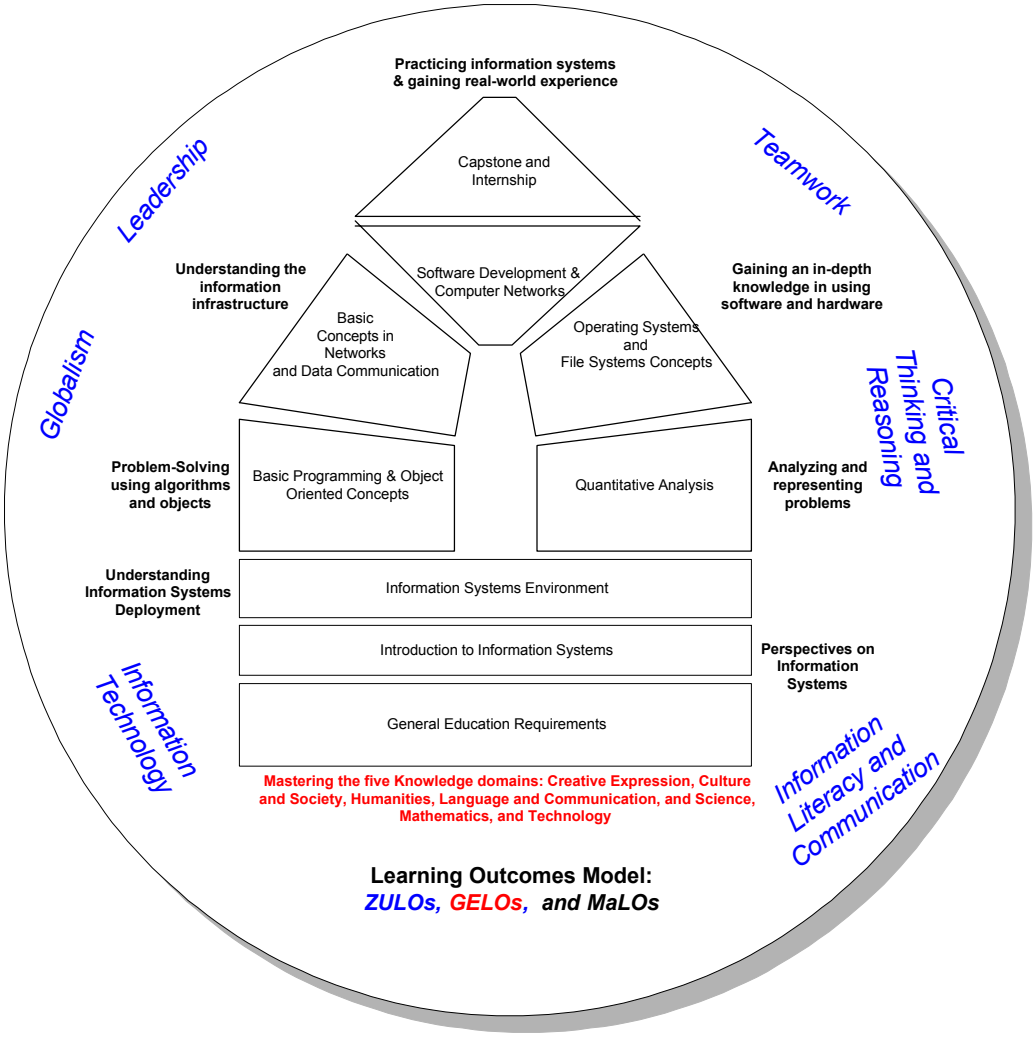

Fig.2. CIS Knowledge Domains and University Learning Outcomes

4.2 The College of Information Systems Curriculum

The College of Information Systems curriculum is designed to reflect the UAE's need for graduates that are well prepared to enter the workforce and to assume their place of responsibility and leadership in the family, community and the nation. The goal of the college is to produce graduates having strong technology and communication skills as well as a good understanding of business practices and work ethics.

During the initial phase of the college, the emphasis of the curriculum was centered on teaching concepts in information systems. However, the curriculum was not developed with the needs of the country in mind. Also the emphasis was on lecturing rather than student learning. When the university shifted to the APM, the focus shifted from teaching and input style course delivery to student centered learning and feedback. The new IS curriculum was developed to ensure alignment with the college and university's learning outcomes.

The College of Information Systems ' curriculum includes the following knowledge domains: Software development, Networks and data communication, File structure and operating systems, Object oriented programming, Quantitative analysis, and Technical communication. Furthermore, the curriculum includes independent study components that provide the students with the opportunity to gain in-depth knowledge of current information systems technologies, methods, and practices. There are two learning modes that have been incorporated into the Information Systems Curriculum. These are: Guided self-learning mode and Guided Teamwork mode. The college has implemented the guided teamwork mode through the implementation of CIS39x and has defined and developed guided self-learning mode requirements in the form of the senior project and internship program. Figure 3 depicts the proposed structure of the Information systems curriculum.

4.3 Using Assessment to Foster Learning

The purpose of outcome-based learning assessment is to improve the quality of learning and teaching in the College of Information Systems. It is based on three fundamental principles:

- Student learning is the focus in the classroom
- Students must be able to apply their learning beyond the classroom
- Students should become effective, independent, lifelong learners as a result of their educational experience.

Assessment of the Major Learning Outcomes addresses these principles by allowing students to demonstrate what they have learned. In the development process, they engage in synthesis, documentation, self-assessment, and reflection on their learning experiences. The College requires students to track and provide evidence of their significant learning experiences. To facilitate this process, students take special courses to learn how to collect pieces of evidence selected from classroom projects and out-of-class activities. Students provide evidence of their achievement by creating an electronic portfolio reflecting their learning experiences. Each student's electronic portfolio is a collection of her work, which allows her to demonstrate academic achievement and personal growth, and also record her progress over time. Moreover, the electronic portfolio allows each student to see the relationships between various educational experiences (curricular and extracurricular) and represents samples of her best work. Portfolios also contain explanations of how those samples demonstrate achievement of the university's learning expectations.

During their fourth year, students are expected to present an oral defense of their abilities to an assessment panel. The assessment panel requires each student to discuss her development in the university learning outcomes: a piece of evidence, which represents their best work, a reflection on the outcome achievements, and a statement of how they have satisfied the college requirements. At the end of the presentation, the assessment panel provides oral and written feedback (assessment report) to students regarding their developmental level in each learning outcome. The assessment report will become part of the student's record. The College then uses the assessment results to determine each student's degree of preparation for the internship. If

the results indicate the need for further preparation, an individualized learning plan will be developed for the student.

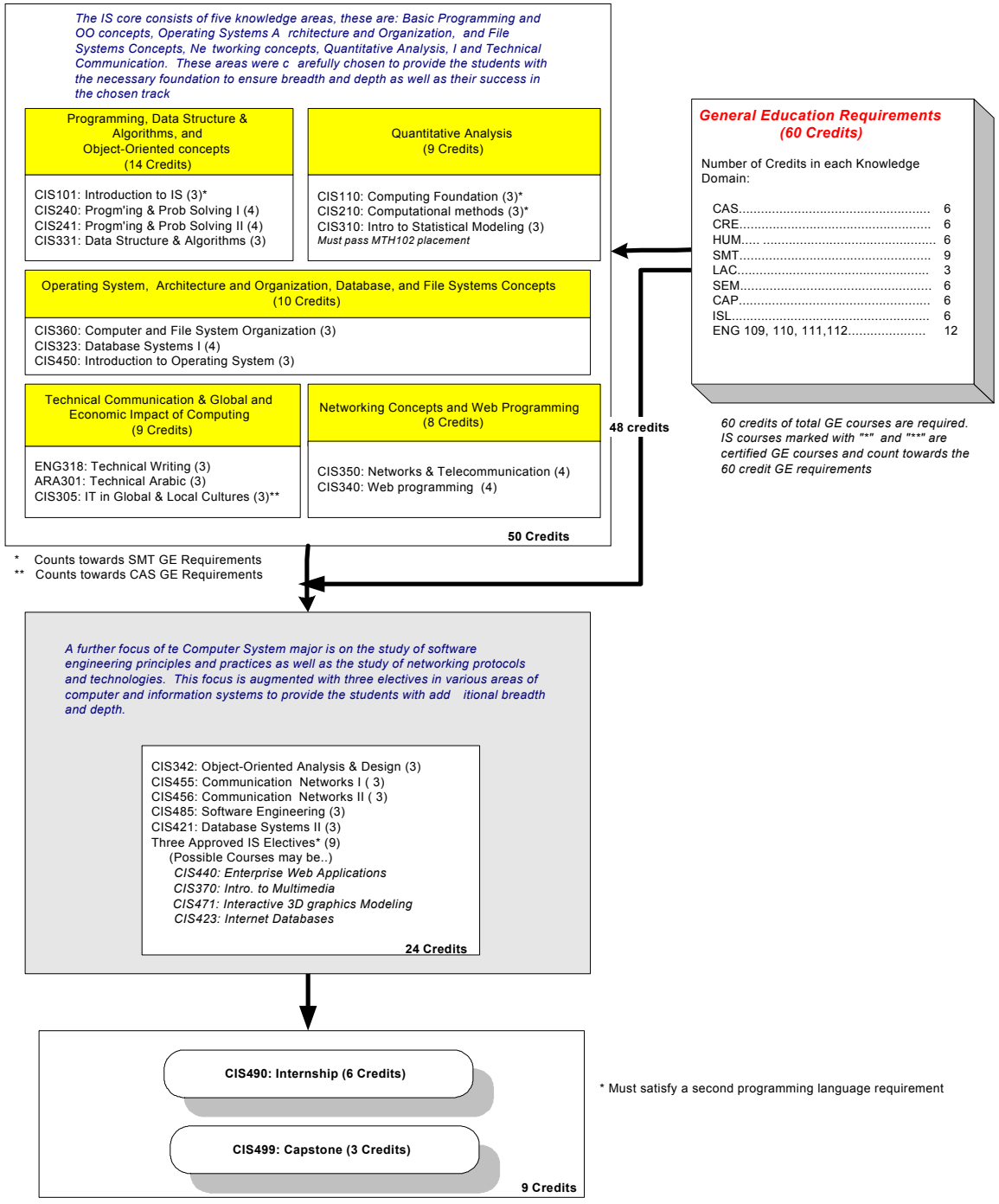

Fig.3. Information Systems Curriculum

The College of Information Systems developed a spreadsheet to document each student's achievement in ZULOs and MaLOs. The MaLOs are course embedded. The spreadsheet in Table 1 shows only sample courses. The spreadsheet is used to assess the student's readiness for the internship and capstone project (Table 1).

Learning Outcomes Status for :											
	CIS	CIS	CIS	CIS	CIS	...	------ Pre-internship ------			
Course :	101	215	240	241	303	...	Status	Reqmnt	Shortfall	Exceeded
Course completed (X):										
Outcome										
ZULOs: (1-beginning, 2-developing, 3-accomplished)										
Information Literacy /Communication	1				1	...		2	X	
Information Technology	2	2	2	2	2	...		3	X	
Critical Thinking and Reasoning		1	1	2	1	...		2	X	
Global Awareness	1				1	...		3	X	
Teamwork					2	...		3	X	
Leadership						...		2	X	
MALOs: (1-beginning, 2-developing, 3-accomplished)										
Problem Identification /Analysis		2		2	1	...		2	X	
Problem Solving	1	1	1	2	1	...		2	X	
Internet Technologies /Applications	1	1		2	2	...		3	X	
Multimedia Systems	1				1	...		2	X	
Technical Communication	1		1		2	...		2	X	

Table 1. Achievement of learning outcomes record

5. Conclusions

In this paper, we introduced a new concept for developing and assessing an Information Systems Academic Model. The proposed hybrid academic model is based on learning outcomes and on grade point average. The model shows how a set of well-chosen learning outcomes was used to develop the Information Systems curriculum. These outcomes are derived from the college's vision of the knowledge and skills that students need to acquire in order to be successful in gaining employment. Special courses are used to support students in their understanding of the learning outcomes. In this academic model students learned how to develop an electronic portfolio to document and reflect on their learning experiences. Assessment and feedback are used to make the learning outcomes component work effectively in the students' learning experiences.

It is too early to assert the effectiveness of this newly adopted academic model. The challenges that face the faculty are numerous. Some of the issues that need to be addressed are: how will faculty effectively implement these learning outcomes in their course delivery; how to assess

students in a way that will contribute to their learning experiences; and how to encourage faculty to adopt the feedback/learning approach. The new academic model is a dynamic model that will evolve with demands from the learning community in the university and the country at large. This new academic model has the potential to address issues on curricular design for successful career placement, and producing graduates with skills and abilities needed by the country.

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