

Content Management System Tools to Enhance Student Learning in Higher Education

Kenneth Pierce
Texas State University System

Lisa Sosa
University of Texas at San Antonio

Maegen Fredrickson
University of Texas at San Antonio

Vanessa Hammler Kenon
University of Texas at San Antonio

This investigation will examine the importance of the integration of tools that are vital to student retention, academic success, and the efficient movement through the graduation pipeline. This work will evaluate some of the current CMS tools used in higher education and how those tools are assisting students, faculty, and staff navigating through the system. Empirical evidence suggests that leveraging CMS tools benefits students, employers, and funders of higher education because the quality of data collected is relevant and useful (Alalwan, Thomas, & Weistroffer, 2014). This research is divided into seven distinct sections: Defining Content Management Systems, Evolution of CMS tools in the Higher Education Process, Current Generation of CMS tools in the Higher Education Process, Role and Amalgamation of CMS Tools in the Graduation Pipeline, The Digital Campus in Support of Graduation Rate Improvement, Constructing the Effective Digital Campus, and Barriers Stifling Full CMS Tool Integration. Suggestions for the future of this area are discussed in the summative conclusion.

Keywords: Content Management Systems, student success, higher education, learning management systems

CMS TOOLS

Content Management System (CMS) tools serve a key role in the higher education process in the areas of academics, administration, and student processing (Klebl, Kramer & Zobel, 2010). In most cases, the institution uses numerous different tools and software programs that need to integrate and share information to provide data that is necessary for the student's successful progression toward college graduation (Schaffhauser, 2010; Van Dyk & Conradie, 2007). There can be no doubt that technology has transformed the way education is delivered to people across the globe. We now live in an interconnected world where the traditional concept of formal learning, taking place in a single physical location, is becoming

increasingly less relevant (Turnbull, Ritesh, & Luck, 2019). The concern is that CMS tools seldom accomplish their intended purpose (Haggan-El, Julius, Kenon, & Sluder, 2018; Kenon, Weil, & Wood, 2018; Van Dyk & Conradie, 2007). Indeed, modern learners are becoming dissatisfied with the stand-and-deliver approach to education that dictates attendance times, learning venues, and modes of participation (Turnbull, Ritesh, & Luck, 2019).

This investigation will examine the importance of the integration of tools that are vital to student retention, academic success, and the efficient movement of students through the graduation pipeline. This work will evaluate some of the current CMS tools used in higher education and how those tools are assisting or hindering students, faculty, and staff navigating through the system to the goal of college graduation. Empirical evidence suggests that leveraging CMS tools benefits students, employers, and funders of higher education because the quality of data collected is relevant and useful (Alalwan, Thomas, & Weistroffer, 2014).

This research is divided into seven distinct sections: Defining Content Management Systems, Evolution of CMS tools in the Higher Education Process, Current Generation of CMS tools in the Higher Education Process, Role and Amalgamation of CMS Tools in the Graduation Pipeline, The Digital Campus in Support of Graduation Rate Improvement, Constructing the Effective Digital Campus, and Barriers Stifling Full CMS Tool Integration. Highlights of the seven areas will be reviewed and suggestions for the future are discussed in the summative conclusion area.

DEFINING CONTENT MANAGEMENT SYSTEMS (CMS)

This section will include several definitions for content management systems relating to the areas of higher education discussed in this work and serve as the reason for their selection by the authors. The following academic definitions are wide-ranging and cover several areas of higher education. A content management system (CMS) is defined as:

A software application that allows for the storage, indexing, retrieval, and archiving of content. In addition, it may also allow for version control of content using check-in/check-out. A CMS allows for the reuse of expensive content assets such as brochures, photographs, video, etc. (cybermediacreations.com, August 13, 2012).

CMSs (Content Management Systems) are an important cornerstone for today's web. Around 59.5% of all websites use one of the various CMS platforms such as WordPress, Joomla, Shopify, and Drupal. From the top CMS platforms, WordPress holds the largest market share (63.5% of all CMS-based websites), followed by Shopify (4.5%), Joomla (3.9%), and Drupal (2.6%). A CMS platform aims to provide certain core functionality such as management of users, content, sites, media, templates, and languages. If additional functionality is required, the CMS instance at hand must be extended. To this end, all major CMS platforms support software extensions (Priefer et al., 2021).

Concerning educative entities, a CMS, or a Content Management System is designed to support educational or academic courses. It allows the instructor to create a course website where documents can be uploaded in popular formats (Ninoriya, Chawan & Meshram, 2011).

These definitions serve a general purpose of coverage in higher education, but content management systems encompass so much more and serve a vital role in the entire education process at today's universities.

The work in this research is tied closely to content management systems used as learning management systems (LMS) and their relationship and integration with the rest of the university's content management systems. Learning management systems can be defined as web-based software platforms that provide an interactive online learning environment and automate the administration, organization, delivery, and reporting of educational content and learner outcomes (Turnbull, Ritesh & Luck, 2019). Furthermore, the functions of LMS are:

- Centralize and automate administration

- Use self-service and self-guided services
- Assemble and deliver learning content rapidly
- Consolidate training initiatives on a scalable web-based platform
- Support portability and standards
- Personalize content and enable knowledge reuse (Ninoriya, Chawan & Meshram, 2011).

This description illustrates just how imperative it will be to incorporate this kind of system into the educational workings of individual universities.

The following detailed description of how those systems are utilized provides a picture of the academic side of university content management systems:

Moving to the cloud has further opened the teaching and learning application door--front and back. LMS (Learning Management System) as we know may well become an anachronism very soon. They could all be replaced by mashups wherein educators and learners assemble their systems for teaching and learning out of existing or emerging applications. Most if not, all will exist in the cloud. Many already do. We are seeing developments in this area with email, asynchronous discussions, multimedia, file sharing, collaboration, surveys, quizzes, and virtual meeting rooms. Stay tuned: There is more to come. Free apps and content repositories abound, e.g., YouTube, iTunes, numerous blogs and wikis, Google Apps, SurveyMonkey, and Kodak Gallery. Institutional content can reside there as well as in online journal apps, lecture archives, and digital repositories. The textbook model is in a total state of flux with McGraw Hill Connect and Nookstudy from Barnes & Noble getting a jump on the rest. Pearson's development string already includes MyLabs, eTextbooks (CourseSmart), CourseConnect, and DLRs. The issue of managing digital rights (DRM) will have to be sorted out, but faculty choice is back, and in a significant way (Scheuermann & Bielec, 2011).

Scheuermann and Bielec demonstrate that CMS tools serve a wide range of systems in the university learning environment. In retrospect, the perspectives of Scheuermann and Bielec from 2011 could not be more correct in that CMS tools have become a prominent way of teaching and learning in higher education institutions, especially due to the COVID-19 pandemic shutting down in-person lectures and seminars. In the past year and a half, there has been a significant boom in the use of cloud-based content management systems such as Zoom, Google Meet, Microsoft Teams, WebEx, Skype, and MirrorFly for virtual learning environments. These cloud-based video technologies have allowed for collaboration between faculty and students that has been vital to the academic success of students during the pandemic. Later in this document, the authors also identify many examples of the CMS tool technologies as they relate to admissions, course selection and management, academic advising, and social networks and career services.

Evaluating CMSs from a technical aspect, Suman, Chawan, & Meshram (2011) describe CMS tools from the mechanical, content, procedural, and learning module solution perspective:

"A Content Management System is a collection of procedures used to describe processes in an environment that requires collaboration between different actors. These procedures are designed to manage:

- Data access, based on user roles.
- Collecting and sharing information.
- Data storage assistance.
- Content redundancy check.
- Reporting."

All three of these definitions provide numerous examples of content management systems at work in higher education. These authors and their research point to continuously evolving tools, trends, and systems utilized by students, staff, and classroom academics in higher education.

EVOLUTION OF CMS TOOLS IN THE HIGHER EDUCATION PROCESS

Historical information and literature on the development of current CMS tools and their opportunity for advancement and improvement provide a coherent and usable data set to assist educational leaders to provide students with course choice and tools for academic progress (Faulconer, Geissler, Majewski, & Trifilo, 2014). These tools have moved from paper to computer to maximize utilization possibilities of data, and it is important to develop advising staff by using the computer-based tools now available (Pfautz, 2010). Computerized CMS tools now serve an important part of the educational equation, especially in tracking institutional data, student schedules, financial aid, and academic progress (Ramaswami, 2007). The role of these tools has become increasingly important in amalgamation with other CMS tools used for student academic progress (Ramaswami, 2007; Schaffhauser, 2010). Unification of numerous data sources on student performance allows educational leaders and academics to plan, prepare, and improve the operations at institutions of higher education. To put practical research to those concerns, technical scholars, research centers, and national organizations such as CCRC, Achieving the Dream, and EDUCAUSE have put a lot of time and research efforts looking into innovative ways to utilize technology to support student progression and succession (Armijo & Velasco, 2018; Grajek, 2018).

Technology-based CMS tools evolved quickly with the emergence and growth of computerized tools in the areas of student course selection, fiscal management, and registration (Ravage, 2012). With the onset of social media, and open-source content, these tools have become important in providing students, academic departments, and staff immediate data and statistics as the information age has pushed to make data more accessible at a quicker pace (Ramaswami, 2007). To that end, institutions have been challenged to find a way to make various CMS tool systems share data in efforts to evaluate, predict, and define student performance and habits. These quick changes, demands for paperless environments, and instant expectations for immediate data have opened the door to a new age of CMS tools, with grand expectations for the integration of software programs.

CURRENT GENERATION OF CMS TOOLS IN THE HIGHER EDUCATION PROCESS

This section will examine the current generation of CMS tools and their evolution and evaluate the roles of those tools in support of the graduation objective. The use of CMS tools has grown rapidly, and these tools continually become more important to the student success process in higher education (Ravage, 2012). CMS tool growth is not only rapid and continuous but much more complex than the pen and paper tools of the past (Pfautz, 2010).

CMS tools have expanded to student services to include detailed academic advising, learning management systems, student services, career services, alumni associations, housing, social networks, and numerous other interconnected components of the educational process (Etches-Johnson & Baird, 2010). It has been proven impossible to connect these new expansions with the initial applications of CMS tools that include tools for admission evaluation, course selection, course management, and financial aid management. Institutions of higher education are working harder to connect CMS tools that deal directly with student retention and academic success (Ravage, 2012). These tools would include course selection, academic advising, scheduling, learning management systems, and financial aid management. Higher education administrators are finding data related to the amalgamation of these CMS tools is incredibly important to student retention, academic success, graduation, and career choices (Grajek, 2014).

ROLE AND AMALGAMATION OF CMS TOOLS IN THE GRADUATION PIPELINE

CMS tools play a crucial role in the movement of college students from the admissions process on to graduation, as well as the career selection process associated with completion of the degree and after graduation employment (Braender, Kapp, & Years, 2009; Pfautz, 2010). The previous section introduced the numerous CMS application tools associated with the higher education process. The following section will take a closer look at each of these components and their role in student academic and career success.

ADMISSIONS

The role of CMS tools begins to affect student progress through higher education before post-secondary entry. CMS programs are vital in the selection process for college and university admissions departments in the ranking process to decide who will be admitted (Dougherty, Mellor, & Shuling, 2005). In addition to the admission selection and ranking process, CMS programs are utilized by admissions and academic departments in deciding which students enter honors and specialized academic learning community programs (Dougherty, et al., 2005). CMS tools designed for course storage, processing, registration, and student course selection are utilized by the university after the student has been admitted. The use of CMS tools for the admission process at universities and colleges is not a new concept. In 2001, Texas A&M University purchased the Panagon enterprise content management system which aided in several student applicant processes including admissions and financial aid. At the time of purchasing this content management system, Joseph A. Estrada, assistant provost for enrollment at Texas A&M University stated that the system “will enable a variety of campus administrative and academic units to connect, share documentation, and process application information more efficiently - thus, providing a better service to Texas A&M University’s prospective students. The e-Process system will enable us to streamline the student admissions process without losing the ability to meet each applicant’s unique needs as we deliver applicant information on an enterprise-wide basis via the Web.” This CMS also reduced the amount of staff overtime costs, reduced the wait time to access admissions records, and included adequate web security that only allowed authorized individuals to view student files (Business Editors & High-Tech Writers, 2001).

COURSE SELECTION AND MANAGEMENT

Both academic and registrar offices utilize CMS tools for efficient management of courses to assist student registration as a part of student academic progress. Interactive online catalogs and course registration systems are now important in the student registration process. There are numerous application choices on the market that are utilized by colleges and universities, but few are fully interactive and supply both catalog and registration as a seamless process (Feghali, Zbib, & Hallal, 2011; Ullmann, 2009). Amer Al-Badarenah of Jordan University of Science and Technology and Jamal Alsakran of the University of Jordan propose a helpful type of CMS tool for course selection and management: an automated recommender system used in higher education for students trying to choose elective courses. The proposed system employs an association rule mining algorithm as an underlying technique to discover patterns among courses. The goal of a recommender system is to provide recommendations that users will evaluate favorably and accept. The main steps a recommender system utilizes to propose an item to a user include analyzing user data, extracting useful information, and finally, predicting items to users (Al-Badarenah & Alsakran, 2016). The seamless process of course selection and knowledge of course availability is an important function to student progress, and the ability of the academic advisor to provide information to ensure the student remains on track to graduate on time (Ullmann, 2009). With the combination of CMS tools such as the one proposed by Al-Badarenah and Alsakran and with the help of academic advisors, students are placed on the right track in completing all the necessary courses to graduate.

ACADEMIC ADVISING

Academic Advisors use CMS tool data from admissions, catalogs, and registration databases to assist in individual assessments and direct student progress (Soria & Mumpower, 2012). Assessment and guidance services include course and degree selection as well as schedule-setting to advance student progress. In addition to the admissions, catalogs, and registration CMS data, many higher education institutions also use an advising CMS tool. Like the admissions, catalog, and registration CMS tools, the advising tools are not normally directly connected to the admissions, catalog, or registration CMS tools (Soria & Mumpower, 2012). The disconnect between CMS tools and advising tools often causes problems

between departments attempting to share information to assist students. For instance, in a study conducted by Kristy Chene Dumont of Michigan State University, she researched the integration of a technological tool called the Student Success System (SSS) within the academic advising department at Amey State University. Integration of the SSS into the academic advisors' daily practice only caused minor disruptions and slight improvements to their practice of advising because of the inability to use most of the functions. Further findings of the study reveal that the academic advisors have a strong focus on student success yet do not identify or connect with the broader student success goals of the institution. Dumont concludes that academic advising is constantly changing and evolving due to internal and external forces and that the increased attention to retention, completion, and persistence along with rapid advancements in technology tools to assist these efforts will mark the next era of academic advising practice. Academic advising will need to find ways to deal with rapid changes in technology tools and seek the best practices in transitioning from one tool to another to keep pace with the changes (Dumont, 2021, p. 3). As CMS tools continue to be developed and functionality expands, technology can better serve advising and student support (Ong, 2018).

SOCIAL NETWORKS

Social networks are growing in their service as an integral part of the higher education process (Etches-Johnson & Baird, 2010). Social network components that allow students to share information with classmates, alumni, and friends, now serve a vital role in assisting efforts to improve curricular strategies, course completion, and graduation success for the millennial generation to provide a more engaging platform for participation in the learning process (DiLullo, McGee, & Kriebel, 2011). As a part of this role, higher education is taking a stronger opportunity to utilize social network tools formerly used to share more social and personal types of college information more formally as an integrated CMS tool (Rienzo & Han, 2009). Tools used for informal efforts such as professor evaluation and course content discussions between students are being utilized in a more community-orientated manner. These social networks' CMS tools are taking a formal role at universities in the course and degree planning, scheduling, analysis, and statistics for student academic preparation, as well as a continually expanding role into career services (Braender, et al., 2009). Zulkanain et al. conducted a study in which they aimed to discover the types of current social networks that are used by students for general communication and learning with their classmates and lecturer; meaning specifically their discussions or inquiries related to course content. They also examined the difficulties faced by students and their suggestions for further improvements in adopting social networks for education. Overall, the findings were that 61-67% of students used WhatsApp for communication and learning. It was also concluded that there are no critical difficulties in using social networks for both communication and learning purposes among the student population questioned. As social networks were initially created for communication and sharing, this response shows that WhatsApp is indeed suitable for adaptation for learning purposes (Zulkanain et al., 2019). There are also other social networks utilized today for communication-related to course content such as GroupMe, Facebook, and various other platforms.

CAREER SERVICES

The fluctuating U.S. economy, cuts in financial aid, and increased student loan debt have placed a heavy burden of accountability on higher education in career services. This higher level of responsibility has forced institutions to put more emphasis on tracking student outcomes after graduation (Pfautz, 2010; Stewart, 2007). Career CMS tools such as LinkedIn, Monster, CareerBuilder, as well as personalized university sites are key to helping universities reach students and collect and analyze data that assist the students, alumni, and institutions with career service goals. This method of tracking and services using career CMS tools includes giving employers a more seamless link to potential workforce candidates' preparation for training before the student's graduation (Krisiko, 2011). Some institutions are rethinking roles on campus and viewing data as an institutional asset to expand our understanding of the student experience, student learning outcomes, and student success and to lead efforts to develop data standards

and work with a wide range of constituents to apply predictive analysis to inform our decision-making (Weil, 2018).

Linking the employer, students, alumni, institution, and academic departments seamlessly is important to the success of the college graduate as education and the workplace become more global (Suárez-Orozco & Sattin, 2007). The process of linking these departments and people through CMS tools is growing in importance as the time limit and funds for students shrink and become a more critical component of the higher education success measurement (Ravage, 2012). Technologies are emerging that can enable a deeper student-advising role, moving away from “checking the box” of degree requirements to more engaged relationships that are correlated with student persistence and progression. Making effective use of these technological advances necessitates thinking less about tools and more about our institutional goals (Barden, 2018).

Higher education institutions are working harder to find ways to streamline the links in the CMS toolchain by working to decrease the number of independent tools serving numerous unique areas and using digitally interconnected CMS tools to improve student graduation rates as well as career success. The next area of this research will move into a more technical solution to these issues and present some strong suggestions for success in developing effective digital campuses at institutions of higher education.

THE DIGITAL CAMPUS IN SUPPORT OF GRADUATION RATE IMPROVEMENT

This section of the research will examine trends and suggestions for future CMS tool integration to improve the flow of information along the higher education pipeline in a more seamless manner. This process would allow students to enter post-secondary education, complete scheduled coursework, and graduate more efficiently for both the academic and financial benefit of the student and the higher education institution.

Previous sections of this work have highlighted disconnects between the various CMS tools utilized to carry higher education students from the admissions process through graduation and successful career assimilation. Technical issues related to current CMS tools used to support the graduation pipeline in higher education, as well as missing components and connections, which would support a successful unification process will serve as a source of discussion as a part of the next section of the work.

THE NEED FOR INTEGRATION

The integration of campus-wide, student success CMS tools is important to provide not only a cohesive plan for students but to also decrease gaps in the degree plan process. It is difficult to provide a seamless flow of accurate data and information through the university academic process for students without an interconnected digital process (Pfautz, 2010). That process should cross the campus without gaps in the flow of information between departments as well as to the university student. Most college and university systems do not have coherent, integrated CMS tools, or an electronic plan process in place to accomplish a seamless flow of information (Etches-Johnson & Baird, 2010). The lack of this type of system makes it difficult for a student to complete a four-year degree in four to six years and meet the benchmarks expected by most university systems (Ravage, 2012; Texas Higher Education Coordinating Board [THECB], 2001; THECB, 2003; THECB, 2008). One such system that aids in moving students through the graduation pipeline at the desired rate of 4 years is College Scheduler, a program that helps students plan their courses which was created by Robert Strazzarino. Dr. Joan Hope of *The Successful Registrar* listened to Mr. Strazzarino speak about his program at a session at the American Association of Collegiate Registrars and Admissions Officers Strategic Enrollment Management conference and wrote about it in her article titled “Increase Graduation Rates with Tools that Promote Student Planning.” Strazzarino discussed how when using the College Scheduler, students can input the courses they want to take and block out the times they are not available. Then they hit a button, and the software displays conflict-free options. College Scheduler can pull in the courses from a student’s degree plan in Degree Works at institutions that have that software. Once students choose a schedule, it populates the shopping cart in Banner, PeopleSoft, or Colleague. The

company can also integrate the product with homegrown systems. Another benefit that institutions have experienced that implemented the College Scheduler into their course planning system for students has been an increase in the number of credit hours that students are taking and an increase in enrollment rates. Strazzarino's goal with his program is to help improve graduation rates of institutions by starting with better student planning (Hope, 2016).

The integration of CMS tools is necessary to ensure that students at the tertiary level have a seamless academic experience by ensuring that students can easily access all resources and receive immediate alerts if they fall below the learning curve. According to Tyton Partners (2016), "Success in the form of a truly integrated planning and advising system would enable a student to progress smoothly through (his or) her postsecondary experience, connecting (him or) her to the resources (he or) she needs and facilitating timely outreach by those invested in (his or) her success." In addition, this kind of open-source approach allows for a smoother transition at [the] academic level, by using open-source software, students may use at home, free of the fear of piracy, the same tools they use in schools, while the organizations using this kind of software find some relief on budgets. Several other benefits of these types of systems are:

- Freedom in education
- Maximize the quality of teaching and learning and
- May produce a state-of-the-art learning and teaching environment (Maican & Lixandriou, 2016).

FOUR-YEAR DEGREE PLANS

The four-year degree plans a student review on paper with his or her advisor when he or she entered college as a first-year student are often not easily attainable (Ravage, 2012). Degree plans are often not updated with changing course and pre-requisite assignments. Students also often lose track of their degree requirements when courses change, they lose paperwork, change their major, or change degree plans. Old fashioned paper versions of the degree plans and disconnected software programs do not allow advisors and academic departments the opportunity to mine useful data to help both the student and the university offer improved course offerings at alternative times or in other formats. These alternative formats include hybrid, blended, and fully online courses.

Updated CMS systems for degree plans should allow for a new paradigm in the areas of planning four-year degree plan systems. Key elements of this system should be minimally included:

- Electronically created and approved semester-by-semester plans for all students. Students start with a template degree plan for their desired major and modify from that point.
- A degree plan that supports applicable degree minors.
- Recalculations when things change, providing an estimate of completion.
- Changes to the degree plan trigger alerts to students, advisors, faculty, etc. as required. Alerts are in emails, text messages, etc.
- Alerts when the need for alternate plans and reprioritization arises.
- Intelligence relating to course schedules, registration priorities, prerequisites, and co-requisites.
- Version control.
- Recommendations for completing each course requirement.
- Performance predictions based on predictive analysis and student preferences.

The tool should seamlessly integrate with other CMS tools. Results of the degree auditing capabilities should be accessible to advisors across campus sites and user-friendly for both academic advisors and students. To tie together the CMS tools discussed in this section and the previous sections, the university must work hard to construct an effective Digital Campus Architecture (DCA). At university campuses, the Chief Information Officers are now frequently charged with the role of serving as the chief strategist to tie the university's content management tools together (Scheuermann & Bielec, 2011). This charge was the catalyst for the DCA discussed in this work.

CONSTRUCTING AN EFFECTIVE DIGITAL CAMPUS

This section of the research will tie together the identification, analysis, historical, and review of technical issues with suggestions and an outline for the architecture of a digital campus in support of improving student success and the higher education graduation rate. This digital campus encompasses the use of CMS tools in the areas of degree plans, early alert systems, catalog management, advising, course registration, and student fiscal management. The Digital Campus Architecture (DCA) is centered on the Degree Plan Management System (DPMS), which will be discussed in more detail in the next section of this work. Surrounding the DPMS are seven major components, including:

- The Global Advising System (GAS).
- Intervention and Early Alert System (EAS).
- Catalog Management System (CMS).
- Student Information System (SIS).
- Learning Management System (LMS).
- Business Intelligence Engine (BIE).
- Massive Open Online Courses (MOOCs).

These seven components share information between systems. Additionally, by sharing data between systems the institution will have the ability to generate reports with more detailed and usable information to support the improvement in the areas of student graduation rates.

DEGREE PLAN MANAGEMENT SYSTEM (DPMS)

The DPMS serves as the center of the CMS tools as a part of the Digital Campus and provides data to the online course catalog. The DPMS is comprised of three major tools:

- Advisor Degree Plan Console (ADPC).
- Degree Template Manager (DTM).
- Student Degree Plan Tracker (SDPT).

The purpose of the Advisor Degree Plan Console (ADPC) is to provide advisors with capabilities to perform degree audits, what-if scenarios, and additional information required for advising students. ADPC provides appropriate on-screen and printed reports necessary for advising students. The console retrieves degree plan information from the DPMS and generates degree audit reports to assist advisors with ensuring students meet their department degree requirements. Although not always achievable, the ADPC is best implemented as a component of the Global Advising System (GAS).

The Degree Template Manager (DTM) is designed to create and manage the default degree requirements (templates) for each major offered at the institution. The DTM is a web-based tool designed for managing the default semester-by-semester degree plan for the individualized major, this tool is to be utilized by department chairs and administrators. Multiple degree plans can be managed for the same major based on the timeframe needed to graduate. The DTM receives and stores data in the DPMS. This management tool would need to be built by the institute in-house.

The purpose of the Student Degree Plan Tracker (SDPT) is to provide students with an easy-to-use interactive interface for managing and tracking their degree plans. The SDPT is a separate interface for students only that focuses on the information and actions they need to successfully manage their degree plan. This tracker is highly interactive and would work on computers, tablets, and mobile phones, and it could be shared with parents when given permission access by the student. The tracker is also designed to display alerts and the status of the degree plan to the student.

These three components work within the DPMS to make advising easier and more efficient for both the student and the academic advisors. As a result, the institution would use these tools to provide a fluid system for advising across different campus sites.

Degree Works is a Degree Plan Management System that is gaining increasing popularity at the University of Texas at San Antonio (UTSA) and other institutions across the United States. This tool, which

is a critical part of the iPASS project at UTSA, encompasses all three of the components allowing students to take a proactive approach in monitoring their progress toward degree completion and to receive academic advising in real-time (Ong De Trevino & Duff, 2016). It allows a student and faculty advisor to view up-to-date information about a student's progress toward graduation. The student and advisor can see which major, minor, specialization, and general education requirements have already been fulfilled and which ones still need to be completed (Stony Brook University, 2021).

By offering students and advisors an opportunity to collaboratively utilize this student-facing platform, students are empowered to not only map out a pathway for graduation but can effectively view a potential change in their major, as well as view courses that still need completion. This Degree Plan Management System inspires the student to continuously be proactive during the four years of their degree plan and helps ensure that they have completed all necessary courses needed for graduation.

THE GLOBAL ADVISING SYSTEM (GAS)

An integrated GAS utilizing CMS tools helps to make it possible for advisors in centers and academic departments to work on documents with other advisors as well as students at the same time in a centralized environment. This system can be updated by everybody involved in the process. A strong GAS system that integrates with other CMS tool software should have full functionality consisting of a minimum requirement of the following:

- Integration with other CMS tools for complete student record data.
- Integration with other proposed degree plan management tools implemented at the university.
- The ability to store artifacts from all advising activities, including notes from face-to-face sessions, emails, telephone calls (recordings or notes), chat sessions, and potentially text messages.
- Chat capabilities.
- Storing any scanned documents relating to advising.
- Schedule of appointments.
- Capable of receiving student alerts from external systems.
- Potential alerts to advisors for discussion with a student.
- Mass communication capabilities (emails, text messages, etc.)

A CMS tool with the above comprehensive list of functionality components could be hard to find natively built into one system. This item may require a designed build. On the other hand, this CMS tool would enhance the ability of advisors to provide proper and adequate advice to students as well as provide a data set that would allow the university to make improvements to its processes.

INTERVENTION AND EARLY ALERT SYSTEM (EAS)

Early Alert Systems serve as a source of intervention and, a valuable tool for catching students before they fail (Macfadyen & Dawson, 2010). A strong early alert system gathers data from several systems, with the campus's Learning Management System (LMS) serving as a vital component to the process. Early Alert Systems require continuous and regular updates for success, and most manual systems have proved to be far too slow to show a reliable success rate (Macfadyen & Dawson, 2010). Institutions of higher education have traditionally developed communication and engagement strategies that become part of early warning/alert systems intended to increase student positive academic behaviors and improve student success (Gayheart, 2021). To that end, a CMS system using an EAS has a higher chance of catching failing students and offering academic enrichment opportunities through departments, tutors, and learning resource centers across the campus with the assistance of a multi-functional catalog system.

CATALOG MANAGEMENT SYSTEM (CMS)

The CMS would include both an online course catalog and a printed course catalog. The online course catalog would provide students, parents, faculty, and staff with up-to-date web versions of the institution's course catalog, including interactive search functions offering the ability to quickly find information. Included in this format would be a Hypertext Markup Language (HTML) formatted catalog. Multiple versions would be available, including archives and applications for cell phones.

Downloadable versions of the catalog would also be available from the university website and printed official copies would be produced and certified annually. The printed course catalog would receive all its information from the Catalog Management System, and this system will also serve to support information for the Student Information System (SIS).

STUDENT INFORMATION SYSTEM (SIS)

The SIS was designed to manage a large amount of student data in a detailed and accurate manner to help improve student success. This software permits a campus-wide enhancement of productivity and communication for users. Over 2,400 universities and colleges in 40 countries have adopted this solution (Ramirez-Correa, Rondan-Cataluna & Arenas-Gaitan, 2018). The common functions of the SIS are to support the maintenance of personal and study information relating to handling inquiries from prospective students, handling the admissions process, enrolling new students, creating class and teacher schedules, and handling records of examinations, assessments, marks, grades, and academic progression. Denizhan Demirkol of Aydin Adnan Menderes University and Cagla Seneler of Yeditepe University conducted an empirical study at a Turkish university to investigate how different student groups' backgrounds affect users' emotions, performance, and perceptions of the usability of an SIS. For an SIS to be effective in its functions, it needs to be a system that is usable for students. For an empirical study, two groups, one group involved in Information Technology at the university, and the other the group involved in a different area of the university, each with 16 students, were asked to perform a progression of tasks and then complete surveys. These surveys were: (a) their prompt emotional response to the system, (b), their impression of the usability of the system, and (c) their likes/dislikes of the system. Overall, the findings of the study were that there is a correlation between the demographics/backgrounds of the students and their satisfaction with the system (Demirkol & Seneler, 2019). With empirical studies such as the one conducted by Demirkol and Seneler, the usability of SISs (Student Information System) can be inferred.

Class schedules and enrollment data will be provided by the SIS to the Learning Management System. The SIS also provides student data such as demographics, grades, and test scores to the Business Intelligence Engine (BIE) and provides student information and courses to the Degree Plan Management System (DPMS). Additionally, the SIS provides student data to the Global Advising System (GAS), which pulls data from the Learning Management System (LMS), to provide students with the most up-to-date information on their academic progress.

LEARNING MANAGEMENT SYSTEM (LMS)

A Learning Management System (LMS) is defined as a server-based software program that interfaces with a database containing information about users, courses, and content. In that sense, it resembles other systems designed for e-commerce, payroll, and student records (Kats, 2010). The role of the Learning Management System (LMS) within higher education is to provide a single repository for current semester learning activities, as well as course and student status. LMS (Learning Management System) not only enables the delivery of instructions and electronic resources to improve and augment student learning in a collaborative environment but also allows instructors to focus on designing meaningful pedagogical activities (Turnbull, Chugh & Luck, 2020). The LMS is the host of course information (lectures, notes, syllabi, tests, etc.) for each course taught at the institution. Additionally, the LMS contains a grade book that is kept up to date by faculty for each grading event in the course. The system can store grades, export

grades, and calculate mid-term and final grades. The system also maintains a current list of enrolled students based on integration with the SIS.

The LMS receives course and instructor information from the SIS periodically in an automated manner. The system receives student enrollment information on a near real-time basis (every hour, etc.) and enrolls or de-enrolls students accordingly. The LMS would also send mid-term and final grades to the SIS once each semester through an automated feed. The system would also send grades to the Early Alert System (EAS) daily to keep both advisors and students up to date on current academic progress and attendance issues.

LMS systems also serve a crucial role in the administration of online, blended, and hybrid courses (Ullmann, 2009). In courses where there is minimal to no face-to-face interaction, the design of the LMS module is paramount to the success of the class, both in the presentation of content and in the adaptability of the learning process for the students (Ioannou & Hannafin, 2008; Lane, 2008; Lust, Collazo, Elen, & Clarebout, 2012). In a case study conducted in 2016 by Kelly Falcone of the University of Phoenix, she researched the faculty transition from one prominent LMS system (Canvas) to another (Blackboard) and which one was preferable. The central question of the study was whether faculty from a California community college prefer Blackboard or Canvas, and if so, why? Five themes emerge from the findings, four of the themes related to the study questions. (a) Faculty prefer Canvas LMS, (b) Technology acceptance is important to LMS preference, (c) The LMS is important for designing successful online learning experiences, (d) Changing LMSs is hard, and (e) faculty need professional development focused on understanding course organization using modules and how to communicate with students (Falcone, 2018). With proper integration of LMS systems, both faculty and student experience in utilizing these systems to teach and learn can be positive.

Due to the recent events in both 2020 and 2021, LMS systems are now more than ever more vital to both faculty and students in higher education. With the COVID-19 pandemic shutting down face-to-face learning at colleges and universities for over a year, LMS systems such as Blackboard, Google Classroom, and Canvas have aided in granting a way for faculty to continue teaching and for students to continue learning, only in a virtual environment. A university today *is* their LMS (Peters 2021). And the success of Data from the LMS as well as the other systems discussed in this section all tie into the Business Intelligence Engine (BIE).

BUSINESS INTELLIGENCE ENGINE (BIE)

The CMS tools connection and integration process discussed throughout this section guide students as well as university advisors, academics, and administrators through a cohesively integrated Degree Plan Management System (DPMS). CMS tools discussed in the digital architecture include student information systems, early alert systems, global advising systems, learning management systems, catalog management systems, and degree plan management systems, which all feed information into the BIE for student data analysis.

The purpose of the Business Intelligence Engine (BIE) is to perform analyses of degree plans based on past student performance and academic events, previous, future, and current course schedules, and historical data. This information becomes a part of a student's degree plan. The BIE serves as a large statistical data warehouse as well as a performance predictor of student grades and grade point averages. The engine produces an outlook of student positions in course sections based on total credit hours, it calculates the cost to assist students, parents, and financial advisors, and it calculates the need for individual courses and degree plans. This type of information has proven significantly helpful to both parents and students in working toward academic success (Weiss, Lopez, & Stark, 2011).

The system also can update data based upon the student's current semester grades. The BIE receives grades, testing scores, and enrollment and scheduling data from the SIS. The engine also sends grades, cost, and enrollment predictions to the Degree Plan Management System (DPMS) and receives degree plan data from the DPMS. This portion of the CMS tools' infrastructure would be built after all the other CMS tools and systems discussed above are in place and fully operational.

MOOCs

The 21st century witnessed an educative change in basic assumptions, stemming from the widespread use of Information and Communication Technologies (ICT). With the proliferation of ICT, online, open, and flexible learning moved from the periphery to mainstream education (Zawacki-Richter, Bozkurt, Alturki & Aldraiweesh, 2018). Massive Open Online Courses (MOOCs) have been one of the most significant technological developments in Higher Education in the past decade. MOOCs are open, large-scale web-based courses designed and delivered by accredited higher education institutions and organizations (Deng, Benckendorff & Gannaway, 2019). This kind of online course allows for greater access in which anyone with a smart device and internet connection can participate, regardless of age, gender, geographic location, or educational background (Deng, Benckendorff & Gannaway, 2019). Due to the free access of this course, students of any age, as stated above, can participate in the learning process since it has been observed that adult distance learners are often assumed to have adequate ICT (information and communication technology) skills, yet many have studied only in environments before computers became a household item; therefore, understanding and preparation of these adult learners are crucial to their success (Safford & Stinton, 2014).

Another facet to consider is that:

The number of universities that offer MOOCs has exceeded 700, and the total number of MOOCs has exceeded 6800. MOOCs are considered by many scholars and practitioners to enhance equity in higher education because of their potential to reach a wider audience and to remove barriers to high-quality education offered by elite institutions (Deng, Benckendorff & Gannaway, 2019).

BARRIERS STIFLING FULL CMS TOOL INTEGRATION

This section includes a discussion of barriers educators may face with full CMS tool integration. Barrier one is getting data into the Early Alert System. For an early alert system to be valuable, it needs data. The systems are designed to extract data from the LMS and utilize that data in their analysis and alerting (Lust, et al., 2012; Macfadyen & Dawson, 2010). This response means that all the institutions' grades must be entered into the electronic grade book in a timely fashion by all faculty members. This kind of momentous change may alter the culture of how administrators employ grading tools. Without an elevated level of success in this area, the EAS would not be a value-added component to the architecture, or the graduation rate improvement process for the university.

Barrier two is resource availability for software development. University information technology offices would need to offer a significant level of effort and funding to implement all the components of architecture, especially those that require internal resources. It may be necessary for the university to increase staff to complete the components of architecture.

Barrier three is changing the advising processes. Advising processes at most universities are decentralized and customized for each college or advising entity, with each entity using a variety of tools and methods to approach their jobs in diverse ways. Consistency in processes and procedures must be maintained across the institution.

Barrier four is an alignment of initiatives and resistance to change. It will be critical that all initiatives dedicated to the discussed areas are aligned and stay aligned. University changes at the levels proposed as a part of this plan are usually met with resistance – not because they are bad changes, but because people in organizations are resistant to change (Kotter & Cohen, 2002; Quinn, 2000; Quinn, 2004). For the areas identified in this research to be accepted, barriers must be eliminated through awareness, communication, training, and a common vision for the future.

All stakeholders must be provided adequate information about the benefits of these CMS tools before their launch, this will increase awareness about the tools' effectiveness in fostering student success as well as to create buy-in. Change management training is fundamental as it enables stakeholders involved to

assess the impending change and to foster an embracing attitude necessary for the complete adoption of the tools. To foster a change-ready attitude amongst its advising staff, UTSA in conjunction with staff from Achieving the Dream (ATD), facilitated a Kotter International 8-Step Change Management Training before the launch of its Education Advisory Board's (EAB) Student Success Collaborative (SSC) tool. The training provided an open forum for advisors to discuss their thoughts about the tool and to examine Kotter's 8-Step process for leading change (Ong de Trevino & Duff, 2017).

CONCLUSION, REVIEW, AND SUGGESTIONS FOR THE FUTURE

This research was divided into seven distinct sections discussing CMS tools and their roles to help higher education institutions with graduation rate improvement by integration and sharing of information between systems. Section one defined content management systems and section two discussed the evolution of CMS tools in the higher education process. Section three reviewed the current generation of CMS tools connected to the higher education process from the point of student enrollment to graduation. Section four covered the role and amalgamation of CMS tools in the graduation pipeline. Section five discussed the digital campus in support of graduation rate improvements, and the sixth section focused on the construction of an effective digital campus and outlined connecting a digital campus into a business intelligence system. The seventh section dealt with barriers to full CMS tool integration within the university system. To finalize this, the discussion will move to the future integration of CMS tools for student graduation success.

FUTURE INTEGRATION OF CMS TOOLS FOR STUDENT GRADUATION SUCCESS

Technology plays a significant role in education worldwide (Buzetto-More, 2006; Diem, 2008; Fallows, 2007; Kenon, 2011; Lankshear, 2000; Rose, 2007; Sharpe, 2006), and CMS tools serve at the heart of making 21st-century technology integrate and function. A common misconception is that applying technology to the student experience is fundamentally a technology issue and can primarily be left to the IT (Information Technology) department. This idea is incorrect; the IT department alone cannot design technology's role in defining the student experience. This is an education-wide issue that requires many players from across the academy, including faculty and advisors (Kenon, Weil, & Wood, 2018). There are serious practical implications for the future evolution and integration of CMS tools as well as full-scale business intelligence models which will become more feasible and scalable (Van Dyk & Conradie, 2007). Student graduation success at the tertiary level is contingent upon continued global growth and integration of technology in higher education institutions as well as business.

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