Investigating Applied Baccalaureate Degree Pathways in Technician Education

Executive Summary

Julia Panke Makela
Collin M. Ruud
Stacy Bennett
Debra D. Bragg

Office of Community College Research and Leadership,
University of Illinois at Urbana-Champaign

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The Office of Community College Research and Leadership (OCCRL) was established in 1989 at the University of Illinois at Urbana-Champaign. Our primary mission is to use research and evaluation methods to improve policies and programs to enhance community college education and transition to college for diverse learners in Illinois and the United States. Projects of this office are supported by the Illinois Community College Board (ICCB) and the Illinois State Board of Education (ISBE), along with other state, federal, and private and not-for-profit organizations. The contents of our publications do not necessarily represent the positions or policies of our sponsors or the University of Illinois. Comments or inquiries about our publications are welcome and should be directed to *OCCRL@illinois.edu*. This document can be found on the web at: *http://occrl.illinois.edu*.

Preface

The Office of Community College Research and Leadership (OCCRL) at the University of Illinois is currently engaged in a four-year study of applied baccalaureate (AB) degree pathways in science, technology, engineering, and mathematics (STEM) fields and technician education. The purpose of this work is to identify the shape, scope, and outcomes of these degree pathways, as well as to uncover exemplary and promising practices to inform the efforts of college administrators and faculty, employers, and researchers who have an interest or investment in emerging approaches to college completion.

This document summarizes our first phase of research. Between May 2011 and January 2012, we used a multi-pronged approach including surveys, website review, and document analysis to identify and characterize AB degree pathways affiliated with National Science Foundation's Advanced Technological Education (NSF-ATE) projects and centers. This document provides an overview of the study motivations, terminology, and approach, as well as an integration of findings across all data analyses employed thus far. The findings provide insights into baccalaureate degree pathways in STEM fields and, more specifically, AB degree pathways that prepare technicians and technologists. Additionally, we share findings related to program development, curriculum design, transferrable and nontransferable associate degree programs, data collection practices regarding the outcomes and impacts of degree programs, environmental influences, strategies for communicating with key stakeholders, and concerns about the perceived stigma of applied postsecondary credentials.

For a full discussion of the findings associated with this study, please view the technical report available at http://occrl.illinois.edu/files/Projects/nsf_ab/NSF-AB-TechReport-2012.pdf

Setting the Stage

Examining College Completion with a STEM Lens

In recent years, college completion has emerged as a top national priority for postsecondary education in the United States (e.g., Complete College America, 2011; Lumina Foundation, 2010; Obama, 2009). Approximately 60% of Americans who graduate from high school enroll in some postsecondary education (Carnevale, Smith, & Strhol, 2010) and among these students, about 65% completed with an associate or a baccalaureate degree (Ewell & Kelly, 2009). These estimates reflect first-time, full-time students who are most likely to complete, leaving a sizeable proportion of students, both full-time and part-time, without college credentials. Furthermore, estimates suggest that over 37 million Americans, or 22% of the adult working population, have accumulated some college credits without completing a degree (Lumina Foundation, 2010). Degree completion rates are especially disconcerting for underrepresented populations, including racial and ethnic minorities, low income, first-generation, and adult students, than for majority populations (Lumina Foundation, 2010; Lynch & Engle, 2010a, 2010b).

Concerns about low degree completion rates are intensified by projections for the United States job market. Carnevale et al. (2010) suggest that, by the year 2018, 63% of job openings will require workers with at least some college education. Approximately 12% of positions will require associate degrees and 34% will require at least a baccalaureate degree. Furthermore, individuals with college degrees have lower unemployment rates, increased earning potential, and improved access to continued education and training, as compared to those without college degrees.

The necessity for advanced education is particularly pronounced in science, technology, engineering, and mathematics (STEM) fields. The STEM workforce has been one of the largest growing employment sectors for the past 60 years, having grown 7.7 times larger from 1950 to 2000, compared to the entire labor force, which grew 2.3 times larger (Lowell & Regets, 2006). Continued and increased output from STEM fields is recognized as vital to the country's continued economic well-being and international competitiveness (e.g., Douglass & Edelstein, 2009; Drew, 2011; Toulmin & Groome, 2007).

In addition to being a staple of the United States economy, STEM fields demand a highly educated workforce. In 2008, 92% of STEM employees had at least some postsecondary education beyond high school, with 44% of those individuals having a baccalaureate degree and 27% having a master's degree or higher (Carnevale et al., 2010). These percentages related to educational attainment are projected to remain steady through 2018 as STEM occupations continue to grow and expand, revealing the importance of pathways that begin at the associate level and culminate with the baccalaureate degree or higher level credentials.

Yet, the United States lags behind other countries in quality workforce preparation for STEM career fields (National Academy of Sciences, 2007). Talent is lost throughout the various stages of the educational pipeline, and women and minorities remain significantly underrepresented in STEM majors and careers (e.g., Chen & Weko, 2009; Committee on Underrepresented Groups, 2010; George-Jackson, 2011; Hoffman, Starobin, Laanan, & Rivera, 2010). STEM fields dominated by aging workers need to recruit a new, diverse workforce that is able to continually upgrade its technological skills and competencies. Strengthening the STEM pipeline to, through and beyond postsecondary education is essential to maintaining a vibrant economy an increasingly global economic world.

This combination of growing employment opportunities, increasing demand for an educated workforce, continual retraining of adult workers, and calls for strengthening the educational pipeline points to the importance of studying new and emerging forms of baccalaureate degrees awarded in STEM fields.

Community Colleges and Technician Education

"Unlocking the value of community colleges" (Boggs, 2011, p. 6) has become a common theme for increasing educational attainment and building a competitive workforce (e.g., Business Roundtable, 2009; Obama, 2009). As part of the P-16 educational pipeline, community colleges provide access and support to students to improve success at both the associate and baccalaureate levels. According to National Survey of Recent College Graduates data collected between 2001 and 2007, approximately 50% of students who receive baccalaureate and master's degrees in science, engineering, and health fields attended a community college at some point in their academic careers (Mooney & Foley, 2011).

The National Science Foundation (NSF) has long viewed community colleges as a pivotal piece of the educational puzzle in STEM education. Through various funding efforts, NSF has elevated community colleges into a prominent role for "developing the technical skills of credit and non-credit students" (Community College Times, 2000, para. 9). After announcing their program's funding for community colleges would increase from 83 million to around 100 million dollars for the 2012 fiscal year, the acting deputy director of NSF's Directorate for Education and Human Resources (EHR), Barbara Olds, spoke to the need for STEM education to become universally accessible by saying, "we're not just interested in Ph.D. scientists. We're interested in a STEM-literate workforce and community" (Patton, 2011, para. 4). Other NSF programs have followed suit, recognizing a growing need for community and technical colleges to provide a large portion of the STEM training required in today's job market.

Calls for increases in STEM education, with an emphasis on community colleges as key providers of such education, have accentuated the need for credentialing at all levels: certificates, associate degrees, and baccalaureate degrees. This need also extends to the construction of pathways and programs of study that extend from certificates and associate degrees to and through baccalaureate degrees, in part as a strategy to facilitate the continued growth and career advancement of adult workers.

The Evolution of Applied Baccalaureate Degrees

Postsecondary degree designations in American higher education fall into several categories based on curricular design and transfer relationships between associate degree and baccalaureate degree level coursework. **Transfer associate degrees** (e.g., Associate of Arts, AA; Associate of Science, AS) consist of liberal and academic coursework that is transferable to baccalaureate degree programs. **Applied associate degrees** (e.g., Associate of Applied Science, AAS; Associate of Applied Technology, AAT; Associate of Engineering Technology, AET; Associate of Technology, AT) usually have roots in career and technical education that has been considered terminal (nontransferable) by higher education systems (Koos, 1970). The word "applied" in relation to these degree programs connotes the importance of applied learning, often through contextualized instruction, that encourages direct applicability to the workforce (Pedrotti & Parks, 1991; Perin, 2011).

Traditional baccalaureate degrees (e.g., Bachelors of Arts, BS; Bachelor of Science, BS) that are made up of liberal, academic, and professional coursework, provide a selection of courses designed to offer both breadth and specialization to students. **Applied baccalaureate (AB) degrees** (e.g., Bachelor

of Applied Science, BAS; Bachelor of Applied Technology, BAT; Bachelor of Technology, BT) emphasize applied coursework and applied learning at the upper division or throughout the entire collegiate pathway that begins with an applied associate degree, as previously noted. An intriguing characteristic of many AB degrees is that they accept the transfer of all, or nearly all, credits from applied associate degrees that, in the past, have been considered terminal. This notion of transferring terminal coursework to create pathways for advanced degree attainment where none existed previously has been a defining feature and continues to be an important aspect of AB degrees (Townsend, Bragg, & Ruud, 2008).

Applied baccalaureate (AB) degree pathways offer opportunities for degree attainment in which a baccalaureate degree-granting institution offers a baccalaureate degree program that has established transfer relationships with programs offered by associate degree-granting institutions that emphasize applied associate courses or degrees. These applied degree pathways are not new. AB degree programs can be traced back to the 1970s when a small number of postsecondary institutions in three states created articulation agreements to allow associate of applied science (AAS) students to transfer applied course credits to baccalaureate degree programs (Townsend et al., 2008). The number of states with AB degree programs continued to grow steadily through the remaining decades of the 20th Century. These degrees have accelerated pace after 2000 to the point that the vast majority of states have adopted state policy concerning AB degrees or allow for inter-institutional agreements that recognize the legitimacy of applied courses or degrees counting toward the baccalaureate degree (Bragg & Ruud, 2011). Undoubtedly more research is needed, but growth in AB degree programs over the past decade suggests higher education institutions are increasingly counting credits earned for applied learning toward degrees at both the associate and baccalaureate degree levels.

The growth of AB degree pathways in the United States is attributable to several factors, including advocacy for applied learning options by educators, policy makers, and employers (Ruud, Bragg, & Townsend 2010). Those that support the implementation of AB degrees often point to workforce needs, as well as state and national calls to improve the United States' international competitiveness. Additionally, advocates of AB degrees have cited the potential to promote greater equity in postsecondary education, by providing baccalaureate transfer routes for adult students who have limited geographic access to college and for historically underserved student populations at the postsecondary level (e.g., Arney, Hardebeck, Estrada, & Permenter, 2006; Pulley, 2010; Walker & Floyd, 2005).

Despite the role that AB degrees could play in increasing access to college and improving college degree completion, AB degree programs face considerable criticism. As noted by Ruud and Bragg (2011), providing transfer options to educational programs once considered terminal has raised questions about the quality of the affiliated coursework at both the associate and baccalaureate levels. Townsend (2009) warns that postsecondary education which emphasizes applied learning may not be comparable in rigor to coursework that is theoretically based. Additionally, by providing training in highly specialized fields, educators may run the risk of training students for career fields that have limited openings or that fail to provide stable, long-term employment. Despite strong opinions on both sides, few in-depth studies have been conducted on AB degree policies and programs beyond a 50-state policy analysis conducted by Townsend et al. (2008) and their related case studies in six states (Bragg & Ruud, 2011).

As developments with the AB continue to evolve, a challenge for researchers, policy makers and practitioners is to define AB degree programs. For example, Walker and Floyd (2005) use the term "workforce baccalaureate degrees" to refer to AB degree programs, making a direct link between baccalaureate education and workforce preparation. Additionally, AB degree programs are frequently considered by state agencies to be the preferred credential awarded by community colleges. In these

cases, the AB degree is used synonymously with a **community college baccalaureate** (CCB) degree (which is a baccalaureate degree that is awarded by an institution identified as a community college, technical college, two-year college, or other institution that confers associate degrees primarily). Acknowledging that AB degrees have been defined in different ways (see, for example, Arney et al., 2006; Pulley, 2010; Ruud & Bragg, 2011; Walker & Floyd, 2005), we began our study of AB degrees that prepare technicians and technologists in STEM career fields by using the definition of an AB degree presented by Townsend et al. (2008) due to its direct applicability to our work. Townsend et al. state that:

> The applied baccalaureate degree is defined as a bachelor's degree designed to incorporate applied associate courses and degrees once considered as "terminal" or non-baccalaureate level while providing students with the higher-order thinking skills and advanced technical knowledge and skills so desired in today's job market. (page iv)

This definition recognized AB degree pathways as establishing transfer pathways that encourage students to follow a "logical 'stepping-stone' process" (Bragg, Cullen, Bennett, & Ruud, 2011, p. 20) from an applied associate degree that has historically been considered terminal into the upper division coursework associated with the AB degree program. Following from this definition, AB degrees are awarded either by associate degree-granting institutions (in which case, it is also a CCB degree) or by baccalaureate degree-granting institutions.

Finally, it is helpful to share an understanding of the different curricular models for the AB degree that emerged from prior research, including the 50-state policy study conducted by Bragg and Ruud's (2011). **Career ladder programs** provide stepwise academic and technical coursework extending from the associate to the baccalaureate degree program. **Management capstone programs** are those in which the associate degree program is supplemented with business and management-focused coursework at the upper division. The focus of **upside-down and completion programs** lies almost exclusively on general education coursework, while the lower division is accepted as a general elective block or treated as a large portion of the degree program's major. The difference between upside-down and completion tends to be in the structure and prescriptiveness of the curriculum. Upside-down degree programs frontload the technical course work and compliment it with general education coursework at the upper division level. Completion degree programs tend to be more wide-ranging in their requirements and structure, often maximizing students' chances of completing a baccalaureate degree by awarding credit for prior learning (Taylor, 2000). **Hybrid programs** represent a convergence of these models, with a unique blend between two or three program types.

Studying Baccalaureate Degree Pathways

The Knowledge Gap

National calls for expertise and improved degree attainment in STEM fields (e.g., Chen & Weko, 2009; Huang, Taddese, & Walter, 2000; National Academy of Sciences, 2007) have stimulated the growth of degree programs, including emerging designs that create new opportunities for baccalaureate degree attainment where none previously existed. Little is known, however, about these emerging degree programs. Where are AB degree pathways found? How are AB degree programs structured, and what coursework is included in them? What are the driving factors for establishing AB degree pathways, and what are some of the key characteristics that distinguish AB degree programs? Our research aims to shed light on these and other questions related to baccalaureate degree pathways for technician and technologist education in STEM fields, with a particular interest in AB degree pathways.

Our Approach

We examined AB degree pathways through the lens of the National Science Foundation's Advanced Technological Education (NSF-ATE) program. This was an attractive starting point because the NSF-ATE program offers a direct connection between STEM education offered by community colleges – the institutions that award applied associate degrees and therefore serve as the first step in the AB degree pathway – and STEM career fields.

The NSF-ATE program provides support for the implementation and creation of the ATE projects and centers, which are the focus of this research. According to the ATE grant solicitation, "**ATE centers** provide models and leadership and act as clearinghouses for educational materials and methods. They are cooperative efforts in which two-year colleges work with four-year colleges and universities, secondary schools, business, industry, and government" (NSF, 2011, p. 6). **ATE projects** revolve around either single institutions or small consortia of institutions that intend to improve programs and curricula, establish professional development opportunities for professionals, better train educators and students, and establish programs in STEM fields. The importance of partnerships among two-year colleges, four-year colleges, business and industry, and other organizations is stressed throughout the ATE grant solicitation (NSF, 2011). Considering the focus of our work on pathways from associate to baccalaureate degrees, this focus on establishing inter-institutional partnerships offers promising foundations to support our inquiries.

Our research work to date has focused in three areas: (a) identifying baccalaureate degree pathways in technician and technologist education, (b) exploring the curricula that make up those degree pathways, and (c) describing characteristics of AB degree pathways. A full description of our study methods is available in Appendix A of the technical report (http://occrl.illinois.edu/files/Projects/nsf_ab/NSF-AB-TechReport-2012.pdf), however a brief description is offered here to provide a foundation for understanding the study findings.

Methods

Our study involved three primary components of data collection. First, we identified NSF-ATE projects and centers across the United States that are affiliated with pathways that lead from associate degrees to baccalaureate degrees. This was accomplished via an exploratory online survey that was sent to all Principal Investigators (PIs) who received NSF-ATE grants in the past 20 years, and led to their reporting of 95 baccalaureate degree pathways. This first survey gathered information on all types of

baccalaureate degree pathways (rather than limiting our focus to AB degree pathways) in order to provide context and opportunities for comparison in later analyses.

Baccalaureate degree pathways typically included multiple higher education institutions that offered the associate degree and/or baccalaureate degrees, with as many as five institutions involved in a single pathway (e.g., four associate degree-granting institutions all articulating credits to a single degree program at a single baccalaureate degree-granting institution). When degree pathways crossed institutions, multiple respondents often provided information on the parts of the baccalaureate degree pathway, each person providing details on the part of the pathway with which they were most familiar. For clarity, we use the term "case" to describe each of the 95 baccalaureate degree pathways.

The second component of our research involved exploring curricula associated with the 95 cases of baccalaureate degree pathways identified in the exploratory survey. We searched departmental, degree program, and transfer information pages on the websites of all associate degree-granting and baccalaureate degree-granting institutions involved in each identified baccalaureate degree pathway to locate course requirements and curriculum sequence documents. This aspect of our research was challenging because information posted on the websites frequently omitted key details needed to provide a complete and accurate picture of the baccalaureate degree programs.

Despite recent calls for colleges and universities to post information regarding curriculum sequences, required courses, and outcomes prominently on their websites (e.g., Education Policy Institute, 2006; Jankowski & Makela, 2010), many of the websites of institutions included in our study offered an incomplete, but nonetheless useful, picture of the baccalaureate degree offerings. We found evidence of baccalaureate degree pathways on institutional websites in 51 cases (53.1%), and in 40 cases (42.1%) we could specifically examine course requirement and/or sequencing documents. Review of available documents allowed us to (a) determine whether each case was an example of an AB degree pathway or a traditional baccalaureate degree pathway, (b) determine what curricular models were used (e.g., career ladder, management capstone, upside-down, completion, or hybrid), and (c) to examine similarities and differences among identified curricula.

Finally, we used a follow-up survey and in-depth website reviews to examine identified AB degree pathways. The purpose of these activities was to understand the structure of and potential offered by these emerging opportunities for degree attainment. For the follow-up survey, we were able to contact 74 respondents from the exploratory survey, and received responses from 50 individuals regarding 40 baccalaureate degree pathway cases. Within these cases, survey respondents recommended 10 AB degree pathways that had notable characteristics that the research team should examine closely, where "notable" was defined as having exemplary or promising characteristics in one or more of the following areas: addressing economic and societal needs, curricular alignment, program design, systematic evaluation, and replicability. In-depth website reviews of all departmental and degree program web pages were conducted for all higher education institutions that were involved in these 10 associate-to-baccalaureate degree pathways. The primary purpose of these website reviews was to (a) learn as much as possible about identified AB degree pathways, and (b) to understand how information about these AB degree pathways is communicated to stakeholders.

The remainder of this document shares the primary themes that were uncovered through our research. Eight key themes are presented, which lead to new questions and directions for future research.

Sharing What We Learned

Eight main themes were derived through the analysis of data in this study. The themes address the growth, variety, prevalence, and evolution of baccalaureate degree programs and pathways, as well as potential areas for further inquiry into relationships between applied and traditional associate degree programs, uncertainties about outcomes and impacts, missed opportunities for communication, and challenges identifying terminology that facilitates discussion. Each theme is presented in more detail below.

Theme 1: Baccalaureate degree pathways are dominated by variety.

Findings from the exploratory survey clearly demonstrated a wide variety of baccalaureate degree pathways that prepare technicians and technologists in STEM fields. For example, more than 30 different fields of study were reported for the 95 identified traditional and AB degree pathways. The baccalaureate degree pathways were initiated by a number of sources, including associate degree-granting institutions, baccalaureate degree-granting institutions, NSF-ATE-funded centers, or a combination of sources. In relation to 20% of the identified baccalaureate degree pathways, respondents reported affiliation with one or more community college baccalaureate degrees. Baccalaureate degree pathways not only included historically transferable associate (AA, AS) and traditional baccalaureate (BA, BS) degrees, but they incorporated emerging degree opportunities including applied associate (e.g., AAA, AAS) and AB degrees (e.g. BAS, BAT).

Furthermore, based upon our analysis of curricula, variation was found in the types of degrees involved in specific baccalaureate degree pathways (e.g., applied associate to applied baccalaureate, applied associate to traditional baccalaureate, transfer associate to traditional baccalaureate), as well as the curricular models employed (e.g., career ladder, management capstone, upside-down, completion).

Theme 2: Current definitions of AB degree pathways and programs were insufficient to describe identified cases.

While Townsend et al.'s (2008) definition of AB degrees provided a useful starting point, we found this definition (and others) limiting when comparing it to what we were finding across the landscape of degree pathways in STEM postsecondary education. The definition that guided this study focuses primarily on bachelor's degrees that are "designed to incorporate applied associate courses and degrees once considered as 'terminal' or non-baccalaureate level" (p. iv). This naturally led us to seek applied degree designations (e.g., AAS, BAS) as indicators for inclusion. However, relying on such transparency in the designations of credentials is quite limiting since degree titles are not completely standardized across states, institutions or disciplines.

Some states and institutions prefer the traditional baccalaureate degree designation of Bachelor of Science (BS) in STEM-related programs of study, even when these programs accept the transfer of applied associate courses and degrees and often also incorporate applied coursework and applied learning at the upper division level. In cases such as these, BS degrees accept the transfer of all, or nearly all, credits from applied associate courses and degrees, thereby creating an avenue for baccalaureate degree attainment from a once terminal associate degree. It is intriguing to note that 8 of the 10 notable degree pathways suggested by respondents in this study followed this pathway structure.

We deemed this substantial number of pathways perceived to be AB degrees by respondents as worthy of mention alongside other emerging forms of the AB degree.

During the curriculum analyses, we found articulation agreements in Florida in which respondents identified an AB degree pathway which included an Associate of Science (AS), a traditionally transferable degree designation, that now transfers into a Bachelor of Applied Science (BAS) at a public university. In another Florida case, an AS in Engineering Technology transferred to an AB degree program that was an applied BS in Engineering Technology (BSET) at a primarily associate degree-granting institution, making it a community college baccalaureate (CCB). Examples of these types of transferable associate to AB degrees are supported by past research (Bragg & Ruud, 2011) that shows most CCBs are designated as AB degrees. The relatively new nature of this development, which is tied to the growth in CCBs in particular states, makes it important to follow the development or emergence of these programs.

Furthermore, one case was also discovered in which respondents identified the AB degree pathway designation with associate degrees awarded as an Associate of Science (AS) that transferred to a Bachelor of Science (BS) because of the historical lack of transfer opportunities for students who had completed the associate degree. These respondents argued that, whereas the AS degree is theoretically a transfer degree, in this particular case the AS degree was essentially terminal because "students had nowhere to transfer" to advance their education in a related field.

Upon reflection on the progress of our own work, we believe it has been helpful to broaden our consideration of AB degree pathways to understand the full scope of degree programs associated with technician and technologist education. However, we also see the need for more definitional work. This issue of clarifying definitions and understandings of AB degree pathways deserves much more attention in future research.

Theme 3: New baccalaureate degree pathways are emerging in STEM education, and AB degree pathways have a strong presence.

As evidenced by our exploratory survey, both traditional and AB degree pathways are continually emerging in high-demand STEM fields such as manufacturing and engineering technology, computer and information technology, and biotechnology. Almost 10% of all identified baccalaureate degree pathways were in some stage of development, with plans in some cases to enroll the first class of students in Fall 2012.

Of the 51 degree pathways for which we found evidence of the degree pathways on institutional websites, 68.6% were AB degree pathways, according to our initial and expanded definition (see Theme 2). Furthermore, the follow-up survey asked respondents to name AB degree pathways that were "notable" in terms of having exemplary or promising characteristics. Of the "notable" nominee AB degree pathways, 70% had been developed within the past 10 years. These data, as well as comments from respondents, suggest substantial development of baccalaureate degree pathways in STEM fields over the past decade and a likelihood that program development will continue in the years to come.

Theme 4: Applied and traditional associate degree programs can exhibit strikingly similar characteristics.

When comparing curriculum from transferrable and nontransferable degree tracks that were available in a single field at a single institution, we discovered that in five of eight associate degree comparisons, there were very few differences. In four of these five comparisons, program representatives confirmed that the nontransferable curricula existed first, and that the curricula were modified to create a transferable degree program. Interestingly enough, the modifications tended to be minor changes related to mathematics or writing classes. At three institutions, the changes affected a single class in the entire associate degree curricula. At another institution, two associate degree classes were changed, while the final institution changed five associate degree classes.

In the remaining three associate degree comparisons, more substantial differences existed such that between 30% and 60% of the courses differed between the transferrable and nontransferable degree programs. Some respondents described these degree programs as having different underlying purposes. Yet, at one institution, the program descriptions available online for the two degrees were almost identical.

The similarities found between transferable and non-transferable associate degree programs within this study raise a host of questions about the difference between preparing students for the workforce versus, or perhaps concurrently for, academic transfer. Some of these questions are presented in the next section regarding future research.

Theme 5: AB degree pathways continuously evolve in response to their environments.

Based on conversations with respondents that followed the survey data collection and curricular analysis, we discovered several cases in which AB degree pathways responded to perceived pressures and influences from the environments in which they operate. Influential sources included state policy contexts, higher education institution leadership, and departmental and program-level expectations.

For example, in three Florida community colleges, respondents indicated that their degree programs were considering moving away from offering AAS degrees – a trend that has emerged only a few years after the state began permitting the use of the AAS degree designation. Responding to changes in the State political environment, all three institutions were in the process of modifying their nontransferable AAS degrees into transferable AS degrees. In another Florida case, we identified a degree program that had recently moved the baccalaureate degree offerings from a public university to a primarily associate degree-granting institution, which offers a few CCBs.

Further, respondents from an institution in Washington state indicated that their creation of a transferable Associate of Applied Science–Transfer (AAS-T) degree in Energy Management was in response to their campus administration's encouragement to articulate the degree with a specific baccalaureate degree program. This AAS-T degree program was developed as a modification of a nontransferable Associate of Technical Arts (ATA) in Energy Management, which was launched just one year before the transferrable option.

Finally, a baccalaureate degree-granting institution in California shared their process of reshaping descriptions and curricular maps for their degree program in response to their departmental recognition that more native students than transfer students were pursuing upper-level baccalaureate degree

coursework. New materials highlight the degree pathway for students who were native to the four-year institution, while making the external prospective transfer student's path less apparent.

Theme 6: Despite recent program developments, limited evidence exists about the outcomes and impacts of baccalaureate degree programs and pathways.

Study findings suggest that considerable uncertainty exists regarding student participation and outcomes. Exploratory survey questions regarding baccalaureate-level degree programs demonstrated knowledge gaps such that, in over half of the cases, information about the availability of student-level outcomes data and recruitment of underrepresented student populations were unknown by survey respondents. Our survey instrument did not request sufficient information to determine whether or not these data are collected, and if so, how they are shared and for what purposes. However, this issue will be examined closely in our continued research.

Based on the follow-up survey and discussions with respondents, several respondents indicated a lack of knowledge regarding the number of students who transferred from the associate degree to the baccalaureate degree, as well as a lack of knowledge regarding outcomes for those students. When data were available, the number of students who transferred to the AB degree programs was quite small in most cases, with some notable exceptions. Several reasons were cited regarding the inability to track student progress, including the small number of faculty (often 1 or 2) who manage these programs not having time and staff support to pursue evaluation and tracking efforts, and the lack of reporting systems that cross institutional boundaries.

Theme 7: Departmental and degree program websites miss opportunities to communicate baccalaureate degree pathways to key stakeholders.

Despite being confident of a baccalaureate degree pathway's existence based on responses to the exploratory survey, we were unable to locate information about the existing pathways in 23 out of 77 (29.9%) cases. Even among the AB degree pathways that had been identified as notable by respondents, gaps in website communications existed. Of the 11 associate degree-granting institutions that are part of the 8 degree pathways identified as notable by respondents and currently enrolling students, only 4 (36.4%) mentioned the transfer relationship with the baccalaureate degree granting institution that was a part of the identified degree pathway. Only 2 of the 8 (25.0%) baccalaureate degree-granting institutions mentioned the transfer relationship with the associate degree-granting institution.

We view the lack of information on institutional websites as a missed opportunity to communicate about the existence of baccalaureate degree pathways. Nowadays websites are a primary way higher education institutions communicate about their academic programs to prospective students. They are sources of information and resources for many other stakeholder audiences as well, including current students, employers, policy makers, and higher education administrators and program directors. The lack of information about baccalaureate degree pathways on these websites contributes to the previous theme of uncertainty. It is a missed opportunity for communication with stakeholders who could benefit from knowing about the existence of the baccalaureate degree pathways and the relationships between the institutions that participate in the baccalaureate degree pathways.

Theme 8: Some respondents avoid applied language due to perceived stigma.

Reminiscent of a pattern observed in OCCRL's earlier work on AB degrees (Ruud & Bragg, 2011), two respondents clearly expressed hesitancy to identify existing degree programs with the "applied baccalaureate" terminology, despite the reality that applied associate degrees that were once considered terminal are now transferring nearly all associate degree credits to baccalaureate degree programs. This hesitancy stems from both a lack of recognition of AB degrees with state policy contexts and concerns about lowering perceptions institutional prestige for those who identify with AB degrees. This is important to keep in mind as it impacts communication about associate and baccalaureate degrees that emphasize applied coursework and applied learning. Terminology can affect the openness to discussion among professionals who need to share and learn from each other's experiences to create, sustain, and evaluate emerging opportunities for baccalaureate degree attainment.

Calls for Future Research

To understand the contribution that AB degree pathways make to national calls for preparing students for STEM careers, addressing gaps in the educational pipeline, and improved degree attainment for underrepresented student populations (e.g., Chen & Weko, 2009; Huang et al., 2000; National Academy of Sciences, 2007), further research is necessary. Analyses of AB degree pathway designs, implementation, and outcomes is needed so that program designers and policy makers can move beyond opinions and assumptions (Townsend, 2005), toward decisions made based on fuller and more complete descriptions of existing and emerging AB degree pathways and evidence of their effectiveness and replicability. This section offers some potential directions for future research.

Pathway Development and Sustainability

The recent growth of baccalaureate degree programs and pathways, particularly those that emphasize applied coursework and applied learning, encourages questions regarding the factors, resources, and environments that support program development and sustainability. For example, what perceived needs are these AB degree programs and pathways established to meet? How are program goals and course content designed? Once an AB degree pathway is developed, what contributes to its sustainability over time? How do programs and pathways evolve over time to meet new internal and external environmental demands? What programmatic characteristics encourage flexibility and longevity?

Outcomes and Data Dissemination

Additionally, questions emerge about the outcomes and impact of baccalaureate degree pathways. It would be helpful to know more about both the intended and the actual outcomes of baccalaureate degree programs. What outcomes are anticipated for these degree pathways? How are student, institutional, employer, and economic impact outcomes measured? What evidence is available to suggest that baccalaureate degree pathways achieve their intended outcomes? What contributes to outcome attainment? Further, we are interested in how outcomes information is shared across the institutions that are involved in baccalaureate degree pathways. What purposes drive data collection, and with whom are the results of data analyses shared? What information and experiences are shared across institutions? What supports the sharing of data, and what additional resources and supports are needed to facilitate this communication?

Replicability

The amount of variety discovered in comparisons of baccalaureate degree pathways results in a picture that is both difficult to describe and compelling to examine. As suggested by earlier research, many efforts to develop AB degree programs and pathways have been quite localized, resulting in an array of program structures and designs, as well as a variety of labels and definitions used to describe programs (Bragg & Ruud, 2011). What does this mean for the replicability of degree pathways or the transferability of lessons learned from one environment to another? What can be learned from one baccalaureate degree program or pathway to be adopted or adapted to another setting?

Stakeholder Communications and Perceptions

The importance of stakeholder communications regarding the existence and outcomes of baccalaureate degree programs was perhaps best highlighted by findings related to this study's examination of websites for programming information, yet questions about communications run much deeper than illustrated by this data collection. On the one hand, there is a need to pay attention to methods of communication. How is information shared with prospective and current students; employers; higher education administrators, faculty, and program directors; and policy makers? What avenues for communication are optimal? On the other hand, issues of perceptions are also key to communication. How are baccalaureate degree pathways, particularly those that include applied coursework and applied learning, perceived by key stakeholders? What contributes to those perceptions? How can the transition of once terminal applied associate degrees into baccalaureate degrees be described in a way that encourages identification and discussion, rather than shuts down conversation?

Comparisons of Terminal and Transferable Associate Degrees

Finally, the comparison of terminal and transferable associate degree programs within this study raised a host of questions about the difference between preparing students for the workforce versus, or perhaps concurrently, for academic transfer. Are these types of preparation so similar that an adjustment of 1-5 classes in a terminal pathway can adequately prepare a student for transfer to baccalaureate degree programs? For example, does the completion of college algebra (as opposed to intermediate algebra) now prepare students for upper-level baccalaureate degree work? Are students in terminal versus transfer associate degree programs differentially prepared for future careers and educational opportunities? If preparation does, in fact, lead to similar outcomes, why is one associate degree pathway terminal while the other is fully transferrable? What value exists for maintaining separate tracks versus merging all pathways into transferable curricula? Should separate tracks be eliminated so that all pathways transfer? Examining these issues from multiple stakeholder perspectives would also be helpful. For example, how do students perceive the similarities and differences between terminal and transfer degree programs? From an equity standpoint, which students pursue terminal associate degree tracks when similar, transferable degree programs exist at the same institution? Who is best served by these curricular decisions?

Broader Implications

This research has clear relevance beyond baccalaureate degree pathway development within STEM fields. It contributes to current conversations about the value of a baccalaureate degree, as well as the historical separation of applied degree programs from traditional academic degree programs (e.g., Bragg, 2001; Levin, 2004; Manzo, 2001; Ruud & Bragg, 2011; Townsend, 2005). We look forward to revisiting these issues in discussions that evolve from the case studies that are planned as this research project proceeds.

Next Steps

OCCRL's team of researchers will continue to pursue the questions raised by this research. During the second phase of this study, to be carried out in 2012 and 2013, our team will conduct case studies with several NSF-ATE projects and centers that are affiliated with AB degree pathways. Our case study work aims to uncover exemplary and promising practices that can inform college administrators, employers, and researchers with up-to-date, detailed information about the development, operations, and outcomes of AB degree programs and pathways in technician education.

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