ABSTRACT

Title of dissertation:	EXPANDING THE ROLE OF MARYLAND COMMUNITY COLLEGES IN K-12 TEACHER PREPARATION: BENEFITS AND COSTS OF IMPLEMENTING THE ASSOCIATE OF ARTS IN TEACHING (AAT) DEGREE
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This study uses benefit-cost analysis to compare three alternative scenarios for implementing the Associate of Arts in Teaching (AAT) degree in Maryland community colleges. The first policy scenario is that community colleges retain their traditional role in K-12 teacher preparation by providing lower-division transfer courses and programs for undergraduate students who are seeking to transfer into teacher education programs at four-year institutions (historical role for Maryland community colleges). The second policy scenario is that community colleges expand their traditional role in K-12 teacher preparation by offering the AAT degree in addition to providing lower-division transfer courses and programs (current role for Maryland community colleges). The third policy

scenario is that community colleges offer the AAT degree as the exclusive lower-division requirement for students seeking admission into teacher preparation programs at four-year colleges and universities (hypothetical future role for Maryland community colleges).

Drawing on the seminal work of Schultz (1963) and Becker (1964; 1975; 1993), human capital theory serves as the guiding theoretical framework for this study. The three policy scenarios under consideration in this benefit-cost analysis were designed to increase a particular type of human capital investment by providing opportunities for community college students to enter the teacher preparation pipeline in higher education. This study examines the benefits and costs that are associated with each of these three alternatives to explore which policy provides the greatest net benefit to the State of Maryland.

EXPANDING THE ROLE OF MARYLAND COMMUNITY COLLEGES IN K-12

TEACHER PREPARATION: BENEFITS AND COSTS OF IMPLEMENTING THE

ASSOCIATE OF ARTS IN TEACHING (AAT) DEGREE

by

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DEDICATION

To Michael, Darren, and Aidan

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CHAPTER 1

INTRODUCTION

This study uses benefit-cost analysis to compare three alternative scenarios for implementing the Associate of Arts in Teaching (AAT) degree in Maryland community colleges. The first policy scenario is that community colleges retain their traditional role in K-12 teacher preparation by providing lower-division transfer courses and programs for undergraduate students who are seeking to transfer into teacher education programs at four-year institutions (historical role for Maryland community colleges). The second policy scenario is that community colleges expand their traditional role in K-12 teacher preparation by offering the AAT degree in addition to providing lower-division transfer courses and programs (current role for Maryland community colleges). The third policy scenario is that community colleges offer the AAT degree as the exclusive lower-division requirement for students seeking admission into teacher preparation programs at four-year colleges and universities (hypothetical future role for Maryland community colleges). This study examines the benefits and costs that are associated with each of these three alternatives to explore which policy provides the greatest net benefit to the State of Maryland.

Drawing on the seminal work of Schultz (1963) and Becker (1964; 1975; 1993), human capital theory serves as the guiding theoretical framework for this study. The three policy scenarios under consideration in this benefit-cost analysis were designed to increase a particular type of human capital investment by providing opportunities for community college students to enter the teacher preparation pipeline in higher education. Human capital theory is based on the assumption that, when educational investments are

made in individuals, their knowledge, skills, and capabilities increase along with their future levels of productivity and earnings in the workplace. Cohn and Geske (1990) explained that, according to this theoretical perspective, "variations in labor income are due, in part, to differences in labor quality in terms of the amount of human capital acquired by the workers" (p. 34). While portions of the economic benefits from investments in human capital are in the form of returns to individuals (e.g., higher earnings), other benefits accrue as returns to society (e.g., higher tax revenues).

The significance of this research study stems from the current challenges faced by states, public school districts, and higher education institutions nationwide to find strategies that contribute to the recruitment, initial preparation, and ongoing professional development and retention of teachers in order to alleviate K-12 teacher shortages. To accommodate growing K-12 student enrollments and to replace teachers who retired or left the profession, the number of working elementary and secondary teachers in public and private schools increased by 26% nationwide between 1991 and 2004, and was projected to increase by another 18% between 2004 and 2016 (Hussar & Bailey, 2007). Moreover, although the number of teachers in the nation's classrooms has rapidly increased in pace with growing K-12 student enrollments, teacher shortages still exist in certain geographic and curricular content areas. The shortage of certified public school teachers has been most problematic in states in the South and West where populations are rapidly growing, in urban and rural school districts, and in the content areas of mathematics, science, special education, and English for Speakers of Other Languages (ESOL) (Curran, Abrahams, & Manuel, 2000).

As states have searched for strategies to recruit and retain high quality K-12 teachers and to meet current and anticipated workforce demands, many have cited community colleges as important and historically overlooked sources for preparing and supplying new teachers (AACTE, 2002; Gerdeman, 2001). In fact, the American Association of Colleges for Teacher Education (AACTE) has cited "building ties with community colleges" as one of its major strategic priorities (Imig, 2003). Proponents assert that teacher preparation programs at community colleges may help recruit more students into the K-12 teaching profession, increase student transfer rates into teacher preparation programs at four-year institutions, and increase the diversity of the K-12 teacher pool because of the high percentages of minority and nontraditional students who attend these institutions (RNT, 2002). Community colleges may also help increase the retention rates of current teachers, particularly in urban areas, since community college graduates often tend to be more committed to remaining in their local communities than other teacher candidates who decide to move out-of-state after graduation (RNT, 2002).

Maryland is an appropriate context for assessing the benefits and costs related to this policy issue because the state is experiencing critical teacher shortages in several geographic and curricular content areas (MSDE, 2008a). In response, the state has been engaged in the evaluation and development of new options for community college involvement in teacher education, including the development of AAT degrees in elementary education and secondary certification subject areas. Maryland also has a comprehensive system of 16 public community colleges that plays a major role in undergraduate education and workforce training and development in the state.

An analysis of the role of community colleges in teacher preparation should not only consider the potential benefits that are derived from expanding the role of these institutions, but also the costs of these actions, including the implications that are associated with allocating resources to these rather than other policy alternatives. Benefit-cost analysis is an appropriate technique for this type of analysis because it provides a systematic framework for comparing the pros and cons of policy choices, it can be used when considering the impact of a policy measure on the distribution of resources, and it requires that policy gains and losses be listed, quantified, and compared for different groups that are affected by the decision (Gramlich, 1990).

In applying these general benefit-cost methods to the current study, I first developed representative student cases to account for the broad range of educational pathways that community college students can potentially take. Drawing upon existing student pipeline data in Maryland, these pathways included an optimal path to degree completion, a typical path to degree completion, and non-completion. Benefits and costs were calculated for each of these student cases, and a net present value was determined for each. Benefits included future employment income and state taxes, while costs included tuition and fees, books and supplies, state subsidies, financial aid, and foregone earnings. Consistent with the methods of benefit-cost analysis, these calculations accounted for the longitudinal nature of policy outcomes (in this case, future earnings and taxes) by discounting future benefits to net present values. I then applied the net present value data derived from these cases to the economic analysis of the three policy scenarios for the AAT degree. Where appropriate, sensitivity analysis was conducted to see how these calculations stood up to a range of assumptions and alternatives.

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Using benefit-cost analysis, this study examines the following four sets of research questions:

1. What economic benefits and costs are associated with optimizing the transfer student pipeline in teacher preparation between Maryland community colleges and four-year institutions? What is the net present value of an "optimal completer" in Maryland?

2. What economic benefits and costs are associated with the typical transfer student pipeline in teacher preparation between Maryland community colleges and four-year institutions? What is the net present value of a "typical completer" in Maryland?

3. What economic benefits and costs are associated with non-completers in the transfer student pipeline in teacher preparation between Maryland community colleges and four-year institutions? What is the net present value of a "non-completer" in Maryland?

4. What is the relative economic value of each of the following three policy scenarios for Maryland community colleges in teacher preparation:

    a) Maryland community colleges retain their traditional role in teacher preparation by providing lower-division transfer courses and programs (historical role for Maryland community colleges);

    b) Maryland community colleges expand their traditional role by offering the AAT degree in addition to providing lower-division transfer courses and programs (current role for Maryland community colleges); and

c) Maryland community colleges offer the AAT degree as the lower-division requirement for students seeking admission into teacher preparation programs at four-year colleges and universities (hypothetical future role for Maryland community colleges)?

This chapter begins with an overview of the K-12 teaching context and teacher workforce shortages, critiques of current approaches to teacher education and certification, and the role and mission of community colleges. It continues with a description of the policy context in the State of Maryland and a summary of the three policy scenarios under consideration in the study. The chapter also contains a discussion of the study's research design and significance to policy and practice. It concludes with an analysis of the limitations of the study's scope and focus and a general overview of the structure and organization of the study.

The K-12 Teaching Context and Teacher Workforce Shortages

In 2000, it was reported that over 2.2 million new teachers would need to be hired nationwide over the next decade to accommodate student enrollment growth, replace teachers who retire or leave the profession, serve increasing numbers of special populations such as K-12 students who need ESOL instruction, and meet federal and state requirements for mandatory class size reductions (U.S. Department of Education, 2000). Between 2000 and 2010, the number of students graduating from public high schools nationwide was expected to increase by 10%, with 13 states experiencing at least a 15% increase in the number of high school graduates (U.S. Department of Education, 2000). In 2007-2008, over 49.3 million students were enrolled in public elementary and secondary schools in the United States, an increase of 5% over 2000 enrollment figures

and 22% over 1990 enrollment figures (NCES, 2010). Also in 2007-2008, there were 4.1 million teachers and other non-supervisory instructional staff working in public elementary and secondary schools, an increase of 11% over 2000 figures and 41% over 1990 figures (NCES, 2010).

Many school districts across the country have encountered difficulties with recruiting sufficient numbers of qualified teachers and, consequently, have issued emergency certificates, provisional licenses, and waivers to staff their classrooms. Darling-Hammond (2001a) observed that students with the greatest need for qualified teachers are often the least likely to get them, as teachers with the least amount of preparation are frequently placed in hard-to-staff schools with high concentrations of low-income and minority students. Out-of-field teaching is also prevalent in today's middle schools and high schools, particularly in subject areas with shortages of qualified teachers (Seastrom, Gruber, Henke, McGrath, & Cohen, 2002).

Teacher shortages often stem from a mismatch between the needs of local school districts and the qualifications of available teacher candidates. Often states have a surplus of qualified teachers in popular certification areas such as elementary education and English, and a corresponding undersupply in fields such as mathematics, science, and special education (Curran, et al., 2000). In addition, many of the available teaching jobs are located in urban schools which traditionally have been difficult to staff. Darling-Hammond (2001a) explained, "Inadequate national and regional information about vacancies, lack of license reciprocity, and inadequate incentives for recruiting teachers to high-demand locations all contribute to the problem of getting teachers from where they are prepared to where they are needed" (p. 13).

The supply and demand issue is further exacerbated by the number of individuals who choose to leave teaching—estimated at 30% to 50% within five years of entering the profession—and the number of prospective candidates who complete teacher education programs in college but never take teaching jobs—estimated at 40% of all teacher education graduates (Curran et al., 2000). In explaining their decision to leave the profession, teachers cite such factors as job-related stress, poor working conditions, excessive bureaucracy, growing job demands, lack of financial incentives, and noncompetitive salaries (Darling-Hammond, 2001a). A lack of ongoing support or professional development opportunities can also contribute to teacher attrition. A National Center for Education Statistics (NCES) study on the preparation and qualifications of public school teachers found that relatively small percentages of teachers felt "very well prepared" to integrate technology into classroom instruction (20%), meet the learning needs of students with limited English proficiency or students with disabilities (20%), or effectively use student performance assessment techniques (28%) (Lewis, Parsad, Carey, Bartfai, Farris, & Smerdon, 1999).

In response, some states have introduced incentive programs to attract new teachers into the profession, particularly in teacher shortage areas. For example, current teacher recruitment programs available in Maryland include college scholarships and grants for teacher education majors, loan forgiveness programs for students who plan to teach in high need areas, signing bonuses, state tax credits for graduate tuition, and housing assistance (MSDE, 2008a). At the same time, many school districts in Maryland are implementing programs for new teacher induction, mentoring, and ongoing professional development to help retain current teachers. In 2002, for example, Prince

George's County Public Schools, the second largest school district in Maryland, expanded its existing new teacher induction program into a comprehensive three-year program with increased opportunities for mentoring and professional development (Prince George's County Public Schools, 2002).

Critiques of Current Approaches to Teacher Education and Certification

The landmark *A Nation at Risk* report, issued by the U.S. Department of Education's National Commission on Excellence in Education (1983), cited the "rising tide of mediocrity" in K-12 education that was causing the nation to fall further and further behind in global competitiveness (p. 1). The Commission's recommendations called for strengthening K-12 graduation requirements with a stronger foundation for all students in English, mathematics, science, social studies, and computer science; setting higher and measurable standards for student academic performance; increasing the amount of time that students were formally engaged in learning; and strengthening the K-12 teaching profession with higher standards for teacher preparation and professional growth (National Commission on Excellence in Education, 1983). *A Nation at Risk* is widely acknowledged to have launched a wave of national, state, and local education reform efforts, continuing to shape the education policy landscape for years to follow (Weiss, 2003).

Over the past three decades, critiques of the quality of teacher preparation programs in colleges and universities have frequently gone hand-in-hand with critiques of the quality of the nation's K-12 education system. Darling-Hammond (2000) summarized common critiques of colleges and schools of education as follows: being ineffective in preparing new teachers, being unresponsive to the needs and priorities of

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the educational community, being remote and detached from what happens in the K-12 classroom, and erecting barriers that discourage bright and capable students from entering the profession. In 2002, then United States Secretary of Education Rod Paige asserted that current academic standards for teachers were "low" and that the traditional system of teacher certification was one of "high barriers, low standards" with "burdensome requirements" (U.S. Department of Education, 2002). The report stated, "The lesson for policymakers and the public is that traditional teacher-training programs do not necessarily produce graduates with superior teaching skills, while at the same time they impose significant costs and challenges on prospective teachers, especially the most talented candidates" (U.S. Department of Education, 2002, p. 19).

A report issued by the Abell Foundation (2001) raised similar critiques of traditional teacher preparation programs and certification processes and called for more flexible regulations for entry into the profession with more emphasis on arts and sciences content preparation and less emphasis on teaching methods and pedagogy. This report also criticized the validity of research findings that teacher preparation in a traditional education program (such as a college or school of education) as opposed to an alternative certification program (such as Teach for America or a fast-track alternative certification program) makes a difference in K-12 student learning, and instead acknowledged and supported studies that link a teacher's verbal ability and subject matter knowledge to greater gains in student achievement. In her response to the Abell Foundation, Darling-Hammond (2001b) countered these arguments by citing research findings that link the lack of effective preparation in pedagogy and teaching methods to higher teacher attrition rates and lower levels of student learning. Based on her review of research, she also

argued that teacher education programs increase the likelihood that teachers will know their content and how to teach it, prepare teachers to teach fundamental learning skills such as reading, and prepare teachers to work with diverse populations such as special education students and students whose first language is not English (Darling-Hammond, 2001b).

In terms of higher education's response to these critiques, multi-campus consortia and collaborations emerged such as the Holmes Group (1986, 1990, 1995), which sought to strengthen the relationship between colleges and schools of education and the rest of the university, to make teacher preparation programs more academically rigorous, to create standards for the assessment and performance of teacher candidates, and to build closer relationships between teacher preparation programs and K-12 school administrators, teachers, specialists, and students. In 1999, the American Council on Education (ACE) Presidents' Task Force on Teacher Education developed a national action agenda for college and university presidents in order to equip them "to lead the nation's campuses in a major improvement in the quality of education provided to teachers and school leaders" (ACE, 1999, p. 1). The report cited such recommendations as clarifying the strategic connection of teacher education to the mission of the institution, mandating periodic campus-wide reviews of teacher preparation programs, increasing coordination between teacher education faculty and arts and sciences faculty, encouraging research and scholarship on the preparation of teachers, and ensuring ongoing support and mentoring for teacher education graduates (ACE, 1999).

Likewise, national accrediting bodies developed standards that require colleges and schools of education to evaluate the effectiveness and outcomes of their teacher

preparation programs. In 2001, the National Council for Accreditation of Teacher

Education (NCATE) created standards for Professional Development Schools,

partnerships between higher education institutions and K-12 schools for the training of

future teachers, professional development of current teachers, and inquiry-based research

into teaching and learning (NCATE, 2001). In 2002, NCATE developed new

performance standards for teacher content knowledge, pedagogical knowledge,

professional skills, student learning, assessment, and clinical field experiences as part of

the national accreditation process for college and university teacher preparation programs

(NCATE, 2002).

The federal government has established several funding programs to further

incentivize K-12 and higher education engagement in teacher education reform. Title II

of the Higher Education Amendments of 1998 created the Teacher Quality Enhancement

(TQE) Program, now the Teacher Quality Partnership (TQP) Program, administered by

the U.S. Department of Education. These multimillion dollar grants are geared toward

innovations in the recruitment, preparation, professional development, and ongoing

support of K-12 teachers through the creation of partnerships between colleges and

universities and K-12 school districts. In 2002, Congress made an initial appropriation of

$160 million to the National Science Foundation (NSF), and later to the U.S. Department

of Education in 2003, to invest in Math and Science Partnerships (MSPs). These

partnership grants are designed to engage disciplinary faculty and colleges and

universities in K-12 teacher preparation, teacher professional development, and

mathematics and science curriculum reform. Like the TQE and TQP grants, they

facilitate linkages between colleges and universities and K-12 school districts to address

partner-identified needs and priorities. MSP projects operate in a highly collaborative research and development environment, with a particular emphasis on evidence-based outcomes and dissemination (NSF, 2007).

In December 2006, the blue-ribbon Committee on Prospering in the Global Economy of the 21st Century, under the auspices of the National Academy of Sciences, released *Rising above the Gathering Storm.* This report laid out a set of essential recommendations believed to be necessary for the United States to remain globally competitive in the 21st century. In addition to strong governmental support for research and industry, *Rising above the Gathering Storm* recommended investing heavily in science and mathematics education from elementary school through graduate school— with a particular emphasis on building and strengthening the educational pipeline for scientists, engineers, and mathematics and science teachers. In fact, "preparing 10,000 teachers to teach 10 million minds" was the very first of a series of recommendation made by the Committee (National Academy of Sciences, 2007).

As policymakers, government officials, and the public in general continue to weigh in on the issue of teacher education and as more higher education institutions— including community colleges—become involved in the preparation of future teachers, teacher preparation will likely remain as a highly visible public policy issue. In the next section of this chapter, the role and mission of community colleges is examined, including developments pertaining to their role in teacher preparation.

Role and Mission of Community Colleges

The early 20th century founding and subsequent development of the nation's community college system (originally called "junior colleges") stemmed from such

forces as the expansion of an industrial-based economy, the demand for more highly skilled workers, an increase in the number of high school graduates due to compulsory education, and the continued rise of specialized research universities, which necessitated the creation of a group of higher education institutions with closer ties to secondary education and the professional workforce (Brazzell, 1996). Substantial enrollment increases in the community college sector over the past several decades (150% between 1970 and 1992) have been attributed to such trends as the availability of federal and state student financial aid, increased higher education participation rates among nontraditional adult students and part-time students, and growing numbers of women and minority students (Cohen & Brawer, 2008). By 1999, community colleges were credited with enrolling half of all first-year college students and over half of all first-generation college students in the United States (Philippe & Patton, 1999). In fall 2008, over 6.6 million students were enrolled in public two-year institutions, an increase of 42% over student enrollments in fall 1998 (Chronicle of Higher Education, 2010).

Community colleges currently fulfill a wide range of functions in higher education, including transfer preparation, general education, vocational and career training, remedial and developmental education, continuing education, and community education (Cohen & Brawer, 2008). Many states, including Maryland, have developed formalized and/or codified statewide articulation agreements between the two-year and four-year sectors to help facilitate a seamless transition for students as they transfer from institution to institution. Nationally, the average two-year to four-year state-level transfer rate is estimated at 22% and ranges from 11% to 40%, depending on the size, structure, and characteristics of the state's higher education system and the student population it

serves (Cohen & Brawer, 2008). In addition to preparing students for transfer to four-year institutions and conferring associate's degrees in the arts and sciences, many community colleges also offer lower-division certificates, technical certifications, and workforce development programs for the acquisition of specific skills.

As states have searched for new strategies to attract more individuals into the teaching profession, many have cited community colleges as important sources for recruiting and preparing teachers (AACTE, 2002; Gerdeman, 2001). A report issued by Recruiting New Teachers, Inc. (RNT) (2002) stated that, although approximately 20% of all current public school teachers entered higher education through a community college, the role of these institutions "in helping to solve the nation's teacher shortage crisis remains relatively unexplored" (p. 8). The RNT report described characteristics of successful teacher preparation initiatives at community colleges in Arizona, Florida, Michigan, New York, Pennsylvania, and Texas.

Although each program site in the RNT report had unique characteristics and served different student populations and communities, the report described these programs as replicable models and identified the following to be salient features of successful teacher preparation programs in community colleges: clear program goals, strong institutional leadership, dedicated and demanding faculty, consistent recruitment and outreach efforts, well-designed and coherent curricula, effective partnerships with four-year institutions, strong student support services, adequate funding for sustainability, and ongoing monitoring and assessment as students move through the program (RNT, 2002). The report also provided policy recommendations for two-year institutions, four-year institutions, funding agencies, and local, state, and federal lawmakers, citing their

collective need to "recognize the potential of these programs by establishing or strengthening policies and resources specifically devoted to ensuring qualified teachers in our nation's schools" (RNT, 2002, p. 30). With their roots in the communities they serve and their mission to contribute to workforce development and extend access to higher education, community colleges appear to be well positioned to make substantial contributions to the education and preparation of future K-12 teachers in their communities and states.

Policy Context in the State of Maryland

Maryland provides an appropriate research context for assessing the benefits and costs related to this policy issue since the state has been actively engaged in innovative community college initiatives geared toward K-12 teacher preparation—namely the development and implementation of the AAT degree over the past decade. Maryland not only has documented geographic and content area teacher shortages, but also has experienced rapid growth in K-12 student enrollments without a corresponding increase in the number of teacher candidates graduating from Maryland's higher education institutions (MSDE, 2008a). In the *Maryland Teacher Staffing Report 2008-2010*, the Maryland State Department of Education (MSDE) (2008a) designated all 24 school districts in the state as geographic areas of "critical teacher shortage." MSDE also declared critical teacher shortages in the content certification areas of technology education, computer science, ESOL, Chinese, German, Italian, Japanese, Latin, Spanish, mathematics, chemistry, earth/space science, physical science, physics, and special education (infant/primary, elementary/middle, secondary/adult, hearing impaired, visually impaired, and severely/profoundly disabled). Maryland school districts that are

unable to hire a sufficient number of qualified teachers in these subject areas may hire individuals with conditional teaching certificates. In 2007-2008, the statewide percentage of newly hired Maryland teachers with conditional certificates was 11.0% (or 798 teachers) (MSDE, 2008a). Personnel hired on conditional certificates are able to teach in the classroom but lack the necessary qualifications for full certification in Maryland— generally courses in their content area or methods courses in education if they entered teaching from another field.

As stated in the 2001 federal legislation *No Child Left Behind*, the reauthorization of the Elementary and Secondary Act of 1965, 100% of all classroom teachers in the United States were required to be "highly qualified" by the 2005-2006 academic year. This means that teachers must hold at least a bachelor's degree, have full state certification, and demonstrate competency in the core academic subject in which they teach (U.S. Department of Education, 2002). Core academic subject areas include elementary education, English, language arts/reading, foreign language, mathematics, science, civics/government, economics, history, geography, and the arts. According to this federal definition of highly qualified teachers, 20.5% of all K-12 public school classes in core academic subject areas in Maryland were not taught by highly qualified teachers in 2005-2006 (MSDE, 2006). Two years later in 2007-2008, the comparable percentage was 15.4% (MSDE, 2008a). Thus, increasing the number of highly qualified teachers in Maryland's classrooms has been and continues to remain an important priority for the state.

Twenty-two of Maryland's 34 public and independent four-year institutions currently offer teacher preparation programs at the undergraduate and/or graduate levels.

All 22 programs are approved by MSDE and follow the 1995 recommendations of the state's *Redesign of Teacher Education* (MHEC, 1995), including intensive student teaching internships in a Professional Development School. According to MSDE (2008a), Maryland's public and independent four-year institutions prepared a total of 2,492 teacher education graduates during the 2006-2007 academic year. The number of Maryland-prepared teacher education graduates has been relatively stable over the past decade, as compared with 2,521 graduates during the 1996-1997 academic year (MSDE, 2008a). In 2006-2007, the largest numbers of teacher candidates prepared by Maryland higher education institutions were in the fields of elementary education (995), special education (397), early childhood education (283), and social studies (197). Of these 2,492 newly eligible candidates from Maryland higher education institutions, only 1,234 (50%) were hired as new teachers in a Maryland public school during the next school year in 2007-2008 (MSDE, 2008a). However, the total number of new hires needed for Maryland public schools in 2007-2008 was 7,249, almost three times the size of the Maryland-prepared teacher candidate pool.

The State of Maryland is not alone in experiencing either K-12 teacher shortages in certain geographic and content areas or an underproduction of teacher candidates from the state's four-year colleges and universities (see Curran et al., 2000). Maryland is, however, the first state that implemented a lower-division teacher education degree as an outcomes-based, statewide program that was developed collaboratively between two-year and four-year higher education institutions. An economic analysis of the benefits and costs that are associated with the AAT degree may be beneficial for educators who develop these programs and create policies for their implementation, as well as

institutional leaders and policymakers who make funding decisions to support such programs. Likewise, the AAT can serve as a model for program development in other academic disciplines. In 2009, for example, the first Associate of Science in Engineering (ASE) degrees were introduced in Maryland community colleges. Like the AAT, the ASE was developed as an outcomes-based degree through a statewide articulation agreement, and was designed to transfer as an entire degree without the need for course-by-course review.

Maryland is also an appropriate site for examining this policy issue because it has a comprehensive system of 16 public community colleges that plays a major role in higher education and workforce development in the state. The statutory role of community colleges, as established in *Section 10-210* of the Education Article of the Annotated Code of Maryland, is to "provide a diverse range of educational services, with particular emphasis on community centered programs and programs that afford open access to persons with a variety of educational backgrounds" (MACC, 2002a, p. 1). Among other benefits, Maryland's community colleges provide a core curriculum of general education, lower-level undergraduate courses in accordance with statewide transfer guidelines, technical and career education programs, skills training in fields of importance to the business community, continuing education programs, developmental and remedial education programs, and public services for citizens in the community (MACC, 2002a).

According to the Maryland Association of Community Colleges (MACC) (2009), Maryland's 16 public community colleges enrolled more than 128,000 students in fall 2008, accounting for 47% of all undergraduate student enrollments in the state. Among

these community college students, 49% were enrolled in transfer programs, 33% were enrolled in career programs, and 17% were undeclared or non degree-seeking. That same fall, 4,557 community college students were enrolled in a teacher education transfer program—2,211 students on a full-time basis and 2,346 students on a part-time basis. In the year prior to the introduction of the first set of AAT degrees in elementary education (fall 2001), the comparable number of community college students enrolled in a teacher education transfer program was 3,585, or almost 1,000 fewer students than in fall 2008 (MACC, 2002b). Although enrollment in or completion of a transfer program does not guarantee that students will continue their education at a four-year institution, these students represent a source of candidates who could potentially enter the teaching pipeline. However, the majority of students who enter community colleges do not complete an associate's degree or transfer to a four-year institution. Among all students who entered Maryland's community colleges as full-time freshmen in fall 2003 (including students enrolled in lower-division programs outside of teacher education), 26.3% transferred to a Maryland public or independent four-year institution (MHEC, 2008a). An additional 8.7% of students in this cohort graduated with an associate's degree but did not transfer, while 11% were still enrolled in a Maryland community college four years later.

The State of Maryland has a history of collaboration between its two-year and four-year sectors via the implementation of statewide transfer and articulation agreements, the development of undergraduate general education outcomes by two-year and four-year faculty disciplinary groups, the creation of regional higher education centers to extend geographic access to bachelor's degree programs, and now, the

development and implementation of the AAT. In terms of generalizability, Maryland's two-year and four-year institutions are not necessarily representative of other state higher education systems because of differences in such characteristics as state history, population demographics, institutional types and sizes, workforce needs, and governance structures (Richardson, Bracco, Callan, & Finney, 1999). However, while different states may not share identical contexts, most do currently share the problem of shortages of qualified K-12 teachers (U.S. Department of Education, 2006). Thus, Maryland's experiences with the AAT can inform policy developments in other states—even those seemingly unlike Maryland—by serving as a model for two-year and four-year institutional collaboration in teacher education.

Three Policy Alternatives for Community Colleges in Maryland

Using benefit-cost analysis, this study compares three alternative scenarios for the role of Maryland community colleges in K-12 teacher preparation. Three alternative scenarios are considered in the study: (a) that community colleges retain their traditional role in K-12 teacher preparation by providing lower-division transfer courses and programs (historical role for Maryland community colleges), (b) that community colleges expand their traditional role in K-12 teacher preparation by offering the AAT degree in addition to providing lower-division transfer courses and programs (current role for Maryland community colleges), and (c) that community colleges offer the AAT degree as the lower-division requirement for students seeking admission into teacher preparation programs at four-year colleges and universities (hypothetical future role for Maryland community colleges).

The first policy alternative defines the historical role of Maryland community colleges in elementary and secondary teacher preparation: providing initial access to higher education for college students who are planning to transfer into a teacher education program at a four-year institution. Under this alternative, community college students may take lower-division courses, complete a portion or all of their general education requirements, follow a recommended curriculum for teacher education ("Recommended Transfer Program"), or complete an entire associate's degree in any major field area in preparation for transfer to a four-year college or university. Depending on the size of the community college, its program offerings, and its degree of emphasis on teacher education, the transfer program curriculum may include lower-division introductory courses in education, prerequisites for upper-division education courses, or field experiences and observations in K-12 schools.

The Maryland Higher Education Commission (MHEC) and MSDE approved the second policy alternative in 2001—a lower-division teacher education degree (AAT)—as an alternative to the traditional Associate of Arts (AA) or Associate of Science (AS) degree. Under this scenario, community college students may choose to pursue either an AAT degree or a traditional associate's degree in preparation for transfer into a teacher preparation program at a four-year institution. Thus, Maryland community colleges have assumed a "blended" role in the teacher preparation pipeline—including the maintenance of their historical role (as described in the first policy scenario) as well as expansion into a new role through the development of the AAT. This blended role for community colleges is the second policy scenario under consideration in this study.

The AAT prepares community college students to transfer into a teacher education program at a four-year college or university through the inclusion of content, pedagogy, and outcomes standards that closely parallel the lower-division teacher education curriculum in the state's four-year institutions, including early field experiences. This degree is designed to recruit larger numbers of community college students into the K-12 teacher pipeline and to provide a seamless transfer for community college graduates to enter teacher preparation programs in the state's public and independent four-year institutions during the junior year. Graduates of AAT programs must still complete the final two years of study for a bachelor's degree at a four-year institution (including upper-division education major requirements, any remaining general education requirements, and other upper-division institutional graduation requirements) in order to become certified to teach in the State of Maryland. Unlike other non-education associate's degree programs in the state, community college students must also meet two additional exit requirements to earn the AAT degree: pass the Praxis I teacher certification exam, and graduate with a minimum grade point average of 2.75 (compared with minimum grade point average of 2.0 for other associate's degree programs). The degree requirements for the AAT are defined in the Code of Maryland (COMAR) regulations, 13B.02.03.02.

AAT degree recipients are not automatically guaranteed admission into a teacher preparation program at a four-year college or university of their choice, however, as "institutions may require applicants to meet other criteria that are applied to native students and/or may admit qualified students on a space available basis" (USM, 2001, p. 1). Although, Maryland's four-year institutions that have a competitive admissions

process for entry into their teacher education programs may give preference to AAT graduates over other community college transfer students. Upon admission to a public or independent four-year college or university in Maryland, AAT graduates are considered to have satisfied the lower-division program requirements for the four-year institution's education major, and the credits for the AAT degree transfer in full without the need for a course-by-course transcript review.

Another difference between an AAT degree and a traditional associate's degree is that the former provides community college students with greater exposure to teaching at an earlier point in their college experience and helps ensure that they are fully prepared to begin the upper-division requirements for an education major by the junior year of study. The AAT is a performance-based degree with benchmarked and assessable student learning outcomes. These outcomes were developed by a group of two-year and four-year faculty from across the State of Maryland (and subsequently approved by each higher education institution with a teacher education program) and were based on standards for teacher education from MSDE, NCATE, and Interstate New Teacher Assessment and Support Consortium (INTASC) (USM, 2001). For example, lower-division outcomes were developed for the following areas of the curriculum for the AAT in elementary education: Foundations of Education, Introduction to Special Education, Educational Psychology, Processes and Acquisition of Reading, Introductory Field Experiences, Health and Physical Education, Arts, Mathematics, Science, Reading, and English Language Arts. For the secondary AAT degrees, faculty defined discipline-specific, lower-division learning outcomes for each teacher certification area.

Community colleges began to launch individually-designed AAT programs in elementary education in 2001, which include 30-36 hours of general education requirements and an additional 30-38 hours of coursework designed to meet the statewide learning outcomes in each of the areas listed above. Currently, all 16 public community colleges in Maryland offer the AAT in elementary education, with five degree programs having been approved in 2001, eight in 2002, one in 2003, one in 2005, and one in 2007. (A statewide list of all approved AAT programs, including those in secondary education, is maintained by MHEC.) Although there are variations in the content and format of individual elementary AAT degrees across Maryland's community colleges (including differences in course requirements, electives, field experiences, and the number of credit hours needed to earn the degree), each AAT program is structured around the same set of learning outcomes and therefore will articulate with all elementary education degree programs in the state's public and independent four-year institutions.

The state's AAT programs in elementary education do not address the subjects that MSDE has determined to be "critical" shortage areas for teachers, including secondary mathematics and science. A unique set of challenges arose in the development of the secondary AAT degrees since, unlike elementary certification, secondary certification in Maryland requires a bachelor's degree in the content area that will be taught in addition to teacher education coursework. Thus, as a content degree, individual AAT programs must be developed in each secondary certification area with close articulation between the lower-division learning outcomes in the AAT and the requirements of the major at each four-year institution. Beginning in 2003, cross-institutional two-year and four-year faculty discipline groups were convened by the

statewide AAT Oversight Council to determine the learning outcomes for the first two years of each major, and the statewide core of the secondary AAT degrees were built around these outcomes. Additional faculty groups were convened during subsequent academic years to other secondary discipline content areas. To date, secondary AAT degrees have been approved and are being offered in chemistry, mathematics, physics, Spanish, and English. An additional AAT degree was developed in early childhood education in 2005, and a special education option was added to the elementary education AAT degree in 2007.

Finally, the third scenario under consideration in this study projects the economic impact that would be associated with requiring the AAT for community college student admission into a teacher preparation program at a four-year institution. Although not currently under consideration in Maryland, this policy alternative is included in this economic analysis for comparison with the traditional and current roles of community colleges since it raises additional questions about the impact of such a policy development on community college students. While this third policy scenario may represent an increase in rigor and standards for Maryland community college students who complete the AAT and gain admission into a teacher preparation program at a four-year institution, it could also potentially serve to decrease options and access for this student population.

While the scope of this economic study focuses specifically on AAT-related alternatives, it is important to mention that there are additional policies and programs could potentially influence the contribution of Maryland community colleges to K-12 teacher preparation in the state. For example, many community colleges already have

partnerships with local school districts to offer professional development opportunities and coursework that teachers with provisional certificates need in order to receive full state certification. Some community colleges have partnerships that enable four-year institutions to offer bachelor's degrees in teacher education at sites more accessible to community college graduates, including the community college campus or one of the state's regional higher education centers. For example, Towson University currently offers a 2+2 elementary teacher certification program at two of the University System of Maryland's regional higher education centers and at the College of Southern Maryland's Waldorf Center for Higher Education. This alternative may be particularly attractive for community college students who are place-bound in geographic areas of the state where no four-year institutions are available. This policy option is more a change for four-year institutions than two-year institutions, however, since it involves the deployment of human and financial resources away from the traditional four-year campus setting to other locations.

Another potential alternative, the expansion of community college missions to offer four-year degrees, has not been implemented in Maryland but was proposed as legislation for Harford Community College during both the 2002 and 2003 sessions of the Maryland General Assembly (Shelsby, 2003). The bill did not pass the House Ways and Means Committee. The State of Florida passed similar legislation for its community colleges in 2001. Community colleges in Florida were permitted to apply to the state to offer bachelor's degrees in areas of severe workforce shortage or in geographic locations where there are no four-year colleges or universities. In May 2002, Miami Dade Community College (now Miami Dade College) gained initial approval from the Florida

Board of Education to offer bachelor's degrees in secondary education and special

education (Lane, 2002). By 2009, more than 1,000 students were enrolled in

baccalaureate programs at the institution, and program offerings had expanded to include

nursing, public safety management, engineering technology, and film production (Lewin,

2009). According to the Community College Baccalaureate Association (2011), there are

currently 15 states with public community colleges that are authorized to confer

bachelor's degrees: Colorado, Florida, Georgia, Hawaii, Indiana, Nevada, New Mexico,

New York, North Dakota, Oklahoma, Texas, Vermont, Washington, West Virginia, and

Wisconsin. Although this option may be a future possibility for community colleges in

Maryland, and indeed in other states, the scope of this benefit-cost study is limited to

policy alternatives within the current role and mission of community colleges as

associate's degree-granting two-year institutions.

Research Design

Using human capital as a theoretical framework, this study uses benefit-cost

analysis to compare three alternative scenarios for implementing the AAT degree in

Maryland community colleges. Benefit-cost analysis is an appropriate method for

addressing the research questions in this study because it provides a rigorous framework

for comparing the economic benefits and costs of various courses of action to project

which alternative produces the greatest net benefit (Levin & McEwan, 2000). Chapter 2

addresses how human capital has been used as a framework to consider economic returns

on investments across a wide range of educational programs and sectors, including

preschool education, elementary and secondary education, vocational education, higher

education, and graduate and professional education. In addition, researchers have used

benefit-cost analysis to study targeted issues in education, including the long-term

benefits of preschool education for economically disadvantaged children, the

implementation of programs to prevent students from dropping out of high school,

college loan programs, and educational investments in developing countries (Levin,

1995a).

Gramlich (1990) characterized public education as an example of a "human

investment" program in which "the nation invests resources and the time of its citizens

now in the expectation that these citizens will be more productive later on" (p. 150). He

developed a benefit-cost model that can be used to assess the benefits and costs of

various human investment programs from both the participants' standpoint and from

society's standpoint. This framework requires the collection of benefit and cost data for

individuals who are directly affected by the policy decision (i.e., participants) as well as

non-participants (i.e., taxpayers), with the sum of these two groups representing the net

benefits to society. Per the "fundamental rule" of benefit-cost analysis, the selected

policy alternative should be the one that produces the greatest net benefit to society

(Gramlich, 1990). In this study, "society" is operationalized as citizens of the State of

Maryland.

Significance of the Study

Using benefit-cost analysis, this study contributes to an understanding of each of

three policy alternatives for Maryland community colleges in K-12 teacher preparation.

By placing benefits and costs into a systematic research framework that considers the

economic impact of each alternative, this study informs broader policy questions related

to the allocation of scarce federal, state, and local resources to teacher preparation

programs in higher education. Although specifically addressing the important policy issue of K-12 teacher quality is beyond the scope of the study, an expansion of the existing role of Maryland community colleges in teacher preparation represents a particular form of investment in teacher quality: an effort to increase and strengthen the state's homegrown pipeline of fully certified teachers who enter higher education through community colleges.

The implications for policy and practice in both K-12 and higher education that this study generates are most relevant to the State of Maryland as the site of the study. Historically, the majority of students who have enrolled in Maryland community colleges have left higher education without earning an associate's degree or transferring to a four-year institution (MHEC, 2008a). As a result, these students lack the necessary qualifications to join the K-12 teaching workforce. The development of the AAT degree is one strategy that Maryland can use to address this trend by providing community college students with early exposure to teaching as a career field, practical experience in K-12 classrooms, support for passing the Praxis I teaching exam, and effective academic preparation for admission into a teacher preparation program at a four-year institution. By examining the benefits and costs of this approach versus other approaches, policymakers can evaluate the implementation of the AAT from an economic perspective.

While the AAT may potentially yield such long-term benefits as higher student transfer rates, higher bachelor's degree completion rates, and a larger pool of certified teacher candidates in Maryland, new degree programs also require additional resources. For example, community colleges must make investments to add new faculty and staff,

engage in curriculum development, recruit students, provide academic advising and support, meet state-level certification standards, and build partnerships with K-12 schools. The opportunity costs that are associated with these new programs represent resources that cannot be invested in other academic programs at the community college or in other teacher education programs at four-year institutions. This study informs such resource allocation questions by considering three alternative scenarios for community colleges and evaluating the economic impact of each alternative on key stakeholder groups to identify the alternative that yields the greatest net benefit.

This study also has methodological implications of potential significance for future research on teacher preparation programs in higher education. As an economic approach, benefit-cost analysis can help educational leaders and decision-makers evaluate policy alternatives in a context that extends beyond parochial interests and political agendas to consider the net societal benefits of each alternative. The research framework developed in this study can be applied to other policy alternatives for community colleges that are not considered in this study as well as to policy alternatives in other states, including "2+2" teacher preparation programs, post-baccalaureate teacher certification programs at community colleges, and the potential future policy development of community colleges expanding their missions to offer four-year bachelor's degrees in teacher education.

Limitations of the Study's Scope and Focus

Although this study has the potential to further knowledge about the role of community colleges in teacher preparation, the analysis also has several limitations related to its scope and focus. First, this study examines only three policy alternatives in

one state and at one point in time. Thus, the analysis of the benefits and costs of these three policy alternatives may have limited generalizability to policy decisions in locations other than the State of Maryland. States may take different approaches in defining the role of community colleges in teacher education depending on the size and structure of the state's higher education system and such trends as the prevalence of K-12 teacher workforce shortages in certain geographic or academic content areas. In addition, this study considers the role of community colleges in initial teacher preparation only and is not intended as an exhaustive review of all the potential roles that community colleges could play in teacher education, including the provision of professional development courses or continuing education coursework. The study is also limited to an investigation of state-level policy alternatives for providing access to the teacher education pipeline for community college students. It does not consider other federal, state, or local policies or practices that seek to address underlying factors that may be related to K-12 teacher recruitment or retention.

A limitation of the methodology, benefit-cost analysis, is that all benefits and costs must be stated in monetary terms. Quantifying benefits and costs can be difficult to do in a systematic manner when outcomes take the form of abstract concepts such as increased life satisfaction, improved self-esteem, or enhanced diversity. Thus, benefit-cost analysis is most appropriate when policy benefits can be converted into monetary terms, or when those that cannot be converted are either minor in the total scope of the study or are constant across the various policy alternatives under consideration (Levin & McEwan, 2000). Benefit-cost analysis represents only one approach for analyzing the implementation of a policy and its impact on individuals and society. Other researchers

conducting an analysis of these policy alternatives may decide that the most compelling issues are societal or political rather than economic, and therefore approach the problem through a different theoretical framework.

Despite these limitations, this study makes an important contribution toward understanding of the role and impact of community colleges in the education and preparation of future teachers. Programs such as the AAT have the potential to bring more community college students into the teacher preparation pipeline, increase student transfer rates into teacher education programs at four-year institutions, and help contribute to the stability of the K-12 teacher workforce. This analysis will inform policymakers and institutional leaders in the State of Maryland and potentially other states about the economic outcomes of three alternatives for doing so. The economic lens that benefit-cost analysis provides is an important contribution to the study of this topic in that decisions around resource allocation and financial viability are central to the development and implementation of public policy.

Organization of the Study

An examination of the benefits and costs of any policy decision should involve an analysis of the broader context of the policy issue and its significance within a larger framework of theory, research, and practice. This study seeks to place the findings of this study into such a framework. Chapter 2 provides a review of the literature relevant to the study, including the theoretical framework of human capital. Chapter 3 outlines the study's methodology, research design, and data analysis procedures. Chapter 4 presents the findings and results of the study, while Chapter 5 discusses conclusions, implications, limitations, and areas for further research on the topic.

CHAPTER 2

REVIEW OF THE LITERATURE

This study compares the benefits with the costs of each of three alternative policy scenarios for the role of Maryland community colleges in K-12 teacher preparation. An examination of the benefits and costs of any policy intervention involves an analysis of the broader context of the policy issue and its significance within a larger framework of theory, research, and practice. Since the policy alternatives under consideration in this analysis are designed as particular forms of investment in individuals and society, human capital theory serves as the theoretical framework for this study.

This literature review begins with an examination of the historical origins of human capital theory and its more recent applications in the field of education, including the work of Nobel Prize winning economists Theodore Schultz (1963) and Gary Becker (1964, 1975, 1993). The chapter continues with an analysis of the role of community colleges in developing human capital. The review concludes with a summary of critiques of human capital theory, a discussion of major areas of convergence and divergence in the research literature, and an examination of what is currently known and not known about the topic.

A broad and substantial body of educational research examines such topics as higher education's role in teacher preparation, the predictors of teacher quality, the relationship between teacher attributes and student achievement, and new teacher recruitment, induction, and retention (see Abell Foundation, 2001, and Darling-Hammond, 2000, for a synthesis of the literature). Chapter 1, for example, presented research that was relevant to the State of Maryland (as the site of the study) and K-12

teacher preparation programs in general, including an analysis of the state-level policy

context and the historical and emerging roles of two-year and four-year institutions in

teacher preparation. While these perspectives inform the current study by establishing its

significance and placing it into a larger context of research and scholarship, the literature

review in Chapter 2 focuses more specifically on the economic framework of human

capital that establishes the theoretical foundation of the study.

Origins of Human Capital Theory

The theory of human capital is based on the central assumption that when such

investments as educational opportunities and training programs are made in people, their

knowledge, skills, and capabilities – and thereby their levels of productivity – increase.

As a result of these investments, economic benefits accrue both to individuals and

society. Although human capital did not emerge as a major theoretical framework within

the field of economics until the 1960s with the work of Schultz (1963) and Becker (1964,

1975, 1993), attempts to evaluate the economic value of individuals can be traced back to

earlier centuries (Cohn & Geske, 1990). Kiker (1971) summarized multiple reasons for

which societies have attempted to treat humans as capital throughout history: to

demonstrate the power of nations, to propose more equitable tax structures, to determine

the total cost of war, to measure the economic effects of investments in education and

health, and to develop compensation schemes for personal injury or death. Sir William

Petty, a British economist in the 17th century, is widely cited as one of the first

individuals who formally attempted to measure the monetary value of individuals (Cohn

& Geske, 1990; Dublin & Lotka, 1930; Kiker, 1971). Petty developed methods to

calculate the portion of the nation's wealth that was created through human labor rather

than through traditional inputs such as land or other forms of physical capital. He also supported the development of new tax structures to assess human capital as well as physical capital and examined the consequences of such factors as death, war, and migration on England's economy (Kiker, 1971).

Although he did not make any attempts to place a monetary value on human life, Adam Smith, Scottish economist and philosopher, addressed the concept of human capital and its contributions both to individuals and society in *The Wealth of Nations*, first published in 1776. In Book II, Smith divided a nation's stock into three parts: capital produced for consumption, fixed capital, and circulating capital. Within the category of fixed capital, Smith (1937) characterized human capital as consisting of "acquired and useful abilities" (p. 265). Smith (1937) theorized that in addition to traditional capital inputs such as machinery, buildings, and land, a nation's productivity could also be measured by the education and training of its citizens. He explained, "The acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person" (Smith, 1937, p. 265). Smith (1937) characterized the resulting increases in production among individuals "in the same light as a machine or instrument of trade which facilitates or abridges labor, and which, though it costs a certain expense, repays that expense with a profit" (p. 266).

Other 18th, 19th, and early 20th century economists frequently cited in the human capital literature as further extending the theories and methods of the field include Ernst Engel, William Farr, Irving Fisher, Alfred Marshall, John Stuart Mill, J. Shield Nicholson, Theodor Wittstein, and Johann von Thünen (Becker, 1993; Cohn & Geske,

1990; Dublin & Lotka, 1930; Kiker, 1971; Schultz, 1963; Sweetland, 1996). Farr, for example, was an English demographer in the mid 1800s who was credited with developing the first scientific methods for placing a monetary value on individuals by capitalizing their future earnings; his methods served as the foundation for work by Dublin and Lotka (1930) in the insurance field a century later. Their book, *The Money Value of a Man*, grew out of a series of Metropolitan Life Insurance Company studies in the United States and included tables listing the monetary values of persons at various ages according to their present and future potential earnings. In addition to calculating how much insurance individuals should carry according their economic value, Dublin and Lotka (1930) also derived estimates related to the cost of raising a child through adolescence, providing compensation for personal injury, and depreciating a person's economic value due to ill health.

In addition to the development and refinement of methods to monetize human capital for such purposes as insurance ratings, another set of factors led to an increased interest in this field during the early to mid 20th century: the observation that the national output of goods and services in the United States had been growing more rapidly than the corresponding labor, capital, and material inputs. Since traditional economic measures for the assessment of national productivity did not adequately account for these increases, economists sought explanations for what could potentially account for these "residuals" (Bowen, 1977; Schultz, 1963; Vaizey, 1962). Applying a human capital framework to this phenomenon, Schultz (1963) theorized that these unexplained gains were due to increases in the knowledge, skills, and productivity of members of the population who had invested in education and training. Thus, the economics of education and the study

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of individual and societal returns on investments in education and training at all levels (including elementary, secondary, vocational, higher education, graduate education, and professional education) became a central area of focus in human capital theory and research.

Investments in Human Capital and Returns to Higher Education

Before Theodore Schultz and Gary Becker substantially expanded the field of human capital theory and its application to education through their respective works *The Economic Value of Education* (1963) and *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education* (1964, 1975, 1993), Harvard researcher J. R. Walsh applied human capital theory to the study of education in the 1930s—with a specific focus on measuring the benefits and costs of higher education. As cited in Cohn and Geske (1990) and Kiker (1971), Walsh sought to examine whether such economic factors as increased earnings appeared to motivate individuals to invest in higher education. He studied the earnings profiles of males at various levels of educational attainment and in various professions, estimated direct costs to students by level of education, and calculated the capitalized future earnings of graduates. Walsh determined that the value of a college education exceeded its costs in some cases but not in others. Most notably, he found that the economic benefits did not exceed the costs of graduate or professional education, but he hypothesized that such nonmonetary benefits as occupational status and prestige would increase the value of the degree to fully cover the cost of the investment (Cohn & Geske, 1990). Although Walsh was criticized for including costs related to room and board (which students would incur regardless of whether they were enrolled in higher education) and for not taking into account the

possibility that factors extraneous to education could be related to earnings differentials (Kiker, 1971), his work provided an important foundation for the use of human capital theory in educational research in the 20th century.

Beginning in the 1950s and 1960s, the seminal work of University of Chicago economists Theodore Schultz and Gary Becker built the foundation for the contemporary application of human capital theory to education and the development of systematic research methods for measuring the benefits and costs of education to individuals and society. In analyzing why traditional measures such as labor and capital inputs did not fully account for growth trends in economic outputs over time, Schultz (1963) theorized that individuals acquire knowledge and skills through education that have an economic value and serve as important (albeit difficult to measure) inputs to national growth and development. He stated, "There are long-standing puzzles about economic growth, changes in the structure of wages and salaries, and changes in the personal distribution of income that can be substantially resolved by taking account of investment in human capital" (Schultz, 1963, p. xi). Schultz (1963) also observed that one of the central economic attributes of education was that it increased future earnings and consumption activities; he hypothesized that economic capabilities were primarily a means of production and that the majority of observed differences in salaries and earnings among individuals – with the exception of what could be attributed to natural abilities – was the result of investments in education. Between the years of 1929 and 1957, Schultz (1963) noted that approximately 20% of the increase in national income could be attributed to higher levels of educational attainment in the American workforce.

At the same time, Schultz (1963) recognized that education was a unique sector when compared with other industries in the economy since it was not administered for profit and since students and families were responsible for a portion of the total cost of education, while society covered the remaining portion. He found that traditional measures of school expenditures (e.g., spending per student, tuition, books, fees) did not adequately account for the total costs of education, particularly those costs borne by students and families. One of the limitations he cited in earlier human capital studies was the omission of students' foregone earnings—income that would have been earned through employment if the student were not in school—which had consistently led to overinflated returns to education. Thus, one of his main contributions to the field of human capital theory was his consideration of the full "opportunity costs" or "indirect costs" of acquiring an education, including students' foregone earnings. In 1956 dollars, Schultz (1963) estimated that foregone earnings represented approximately 60% of the total cost of four years of high school education ($852 in annual foregone earnings) and 59% of the total cost of four years of college education ($1,947 in annual foregone earnings).

Like Schultz, Becker (1964, 1975, 1993) hypothesized that education and training were among the most important investments that individuals and societies could make in building and sustaining human capital. He observed that findings from research studies in over 100 countries had consistently confirmed that high school and college education increased individual income levels in the future, even after netting out educational costs and adjusting for such variables as family background and student ability. Unlike physical capital, which tended to yield diminishing returns over time, he stressed that

human capital provided for sustained economic growth into the future by raising levels of productivity and other labor inputs. At the same time, however, he observed that one of the challenges associated with accurately measuring the returns of educational investments was that the resulting economic gains tended to be long-term (i.e., unfolding over the course of an individual's working life) rather than immediate.

In his research, Becker assessed both the direct and indirect costs of education for individuals and compared the differences in lifetime income levels between high school and college graduates. At the same time, he extended the field of human capital even further by systematically considering the educational costs and benefits to society that were not directly borne by individuals, resulting in the development of research methods to calculate internal rates of return for both private and societal investments in education. A rate of return is defined as the discount rate of interest that would cause the present value of the benefits of a project or investment (in this case, education) to be equal to the present value of all costs that are associated with the project or investment (Levin & McEwan, 2000).

Becker (1993) reported an average private rate of return of 10% to 12% for four years of undergraduate education for the 1939 and 1949 cohorts of white male college graduates in the United States. When faced with the challenge of calculating the comparable social rate of return, he observed, "Economists (and others) have generally had little success in estimating the social effects of different investments, and, unfortunately, education is no exception" (Becker, 1993, p. 208). When taking into account the tax payments on earnings differentials between high school and college graduates minus the cost of foregone tax earnings due to college attendance, Becker

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(1993) calculated a social rate of return of approximately 13% for the 1939 and 1949 cohorts of college graduates.

In addition to Becker, other researchers have calculated rates of return for different levels of educational attainment. Based on their review of prior research over the past three decades, Leslie and Brinkman (1988) reported average private rates of return between 11.8% to 13.4% for a bachelor's degree, 7.2% for a master's degree, and 6.6% for a doctorate. They also estimated an average social rate of return at 11.6% to 12.1% for undergraduate education. In their review, Cohn and Geske (1990) reported a range of private rates of return for four years of college at 10% to 15%, with estimated social rates of return at 11% to 13%. In his review of 53 economic case studies in 32 different nations, Psacharopoulos (1973) reported an average private rate of return of 23.7% for primary education, 16.3% for secondary education, and 17.5% for higher education. The comparable average social rates of return were 25.1%, 13.5%, and 11.3%, respectively.

Due to the imprecision with which the "externalities" and "spillover effects" associated with education can be measured, Bowen (1977) suggested that traditional monetary returns be considered the "lower boundary" for actual rates of return that would more fully reflect the true benefits and costs of education—both monetary and nonmonetary. For example, he identified such benefits of higher education as increased levels of savings, job satisfaction, consumer choice, civic involvement, capacity for adaptability in times of economic change, and consumption of leisure activities. Since these benefits cannot be systematically monetized, they are generally omitted when calculating rates of return on investments in higher education. Although Bowen (1977)

himself took an economic approach to the study of higher education, he cautioned that, "Higher education is concerned with matters of intellect, personality, and value that simply cannot be rigorously quantified or aggregated by adding up dollar amounts or computing rates of return" (p. 22). Through his examination of the monetary and nonmonetary costs, benefits, and outcomes of higher education for individuals and society, he concluded that the monetary returns from higher education alone are likely sufficient to cover all costs, the nonmonetary returns from higher education are several times more valuable than the monetary returns, and the total returns from higher education, both monetary and nonmonetary, exceed its costs by several times.

Role of Community Colleges in Developing Human Capital

Although many human capital studies in higher education focus exclusively on economic returns to a four-year bachelor's degree, community colleges are also important sources for building human capital through their contributions to economic and workforce development in their communities and states and their ability to adapt quickly to external forces (Melville & Chmura, 1991; Nespoli, 1991). Community colleges enroll approximately half of all first-year undergraduates in the United States and fulfill a wide range of missions and functions in higher education, including career and vocational education, developmental and remedial education, community education, general education, continuing education, and lower-division coursework in preparation for transfer (Cohen & Brawer, 2008). As compared with the four-year sector, community colleges also enroll higher proportions of minority students, part-time students, adult students, students from lower income backgrounds, and students with disabilities (Voorhees, 2001).

Although community colleges have been a part of the American higher education system since the early 20th century, these institutions were frequently overlooked in the higher education research and literature until recently (Cohen & Brawer, 2008). As a result, many questions about their impact on individuals and society have been left unexamined. Human capital theory provides one lens for understanding the economic role and contributions of community colleges in American society. With their open admission status, low tuition cost, and roots in the communities they serve, Nespoli (1991) characterized community colleges as "the best vehicle available to the states for investing in human capital" (p. 23).

Using a human capital framework, Kastner (1977) conducted a cost-benefit analysis to measure the economic returns of a community college education to both individuals and society. In his analysis, he considered direct costs to students, direct costs to the taxpaying public, and indirect costs related to foregone earnings and tax revenues, as well as the marginal lifetime income of community college graduates over high school graduates and the application of macroeconomic multipliers to individual returns in order to calculate returns to society. In 1974 dollars, Kastner (1977) calculated a direct rate of return of 5.6% for men and 5.9% for women, while the corresponding returns to society were 12.1% for men and 11.3% for women. When considered over the course of a 45-year work career, the average returns to society were $532,315 for male community college graduates and $385,620 for female graduates. Kastner (1977) acknowledged that the methods he used in this study would likely underestimate the actual benefits of community colleges to society, as they did not take into account the impact of community colleges on the local economy (e.g., creation of jobs, increased

spending) or such nonmarket impacts as the development of a more involved and informed citizenry.

Sanchez and Laanan (1997) observed that the vast majority of studies that have examined the impact of higher education on future earnings have been conducted in the four-year sector and stressed that additional research was needed to examine the economic benefits of a community college education. Using a state-level employment dataset in California including 841,952 students who either completed associate's degrees or vocational certificates or dropped out of community college programs, they compared student earnings during their last year of enrollment in college with earnings three years later. Students who completed an associate's degree experienced a greater percentage change in salary (+58.5%) three years later than those students who had attained a vocational certificate (+32.8%) or who left college without earning a degree or certificate (+22.7% for students with 24 or more credits completed, +16.6% for students with 12 to 23.9 credits completed, and +10.7% for students with less than 12 credits completed). Their discovery of a positive relationship between the number of credits completed and the percentage change in earnings led Sanchez and Laanan (1997) to conclude that even limited exposure to a community college education can have positive economic benefits for students.

According to census data, associate's degree recipients in the United States earn an average of $1.6 million over the course of their working lives, while the general high school graduate population (without an associate's degree or higher) earns an average of only $1.2 million (Day & Newburger, 2002). As reported by the U.S. Bureau of Labor Statistics, associate's degree holders who were 25 and older and employed full-time had a

median annual income of $36,399 in 2001 (Postsecondary Education Opportunity, 2003).

In comparison, high school graduates in this category had a median annual income of

only $29,187. In addition, associate's degree holders experienced lower rates of

unemployment when compared with high school graduates (2.9% versus 4.2%)

(Postsecondary Education Opportunity, 2003). However, as Kastner (1977) indicated,

the true economic benefits of community colleges extend beyond direct returns to

individual students through increased wages and earnings. In citing the multiple areas of

impact that economic and workforce development programs at community colleges have

on their local communities and states, Alfred (1991) described such outcomes as

increased worker mobility, the attraction and retention of industry, increased employer

satisfaction, and fiscal impacts including increased tax revenues, spending patterns, and

employment rates.

In attempts to formally measure these impacts and others for such constituencies

as the state legislature, local industries, and the broader public, some states, including

Texas and Illinois, have initiated economic impact studies of their community college

sectors. For example, a model developed for the Association of Community College

Trustees (AACT) measures returns on community college investments for both students

and taxpayers as well as payback periods for these investments. Using this approach, a

study reported that Texas community colleges stimulated the state's economy by $13.5

billion annually—including $1.9 billion from the multiplier effects of their payrolls and

$11.6 billion from former students working in the state (AACT, 2002). The study also

reported that community college graduates received an average rate of return of 26.1% on

their investment in education and that it took approximately 5.8 years to fully recover

their costs, including foregone earnings. A study using the same methodology reported

that the marginal annual earnings of community college graduates in Illinois added more

than $8.4 billion to the state's aggregate earnings and that taxpayers received a 13.8%

rate of return for their financial support of community colleges (AACT, 2002). Similar to

Sanchez and Laanan's (1997) findings, the AACT studies documented positive financial

returns to students for even short periods of community college attendance.

Critiques and Limitations of Human Capital Theory

Although a vast body of literature applies human capital to the study of education,

some researchers (Benson, 1978; DeYoung, 1989; Dreijmanis, 1991) have cited

limitations associated with this theoretical perspective. One of the major criticisms is that

human capital is a highly theoretical field that is based on the causal assumption that

investments in education lead to increases in an individual's knowledge, skills, and

productivity, which in turn yield increased earnings over the course of an individual's

working lifetime (Sweetland, 1996). The alternative hypothesis for explaining this

complex set of relationships is known as "screening" or "credentialism" in the human

capital literature. It states that higher earnings are not caused by increased worker

productivity, but by the desire of employers to attract and retain workers with higher

levels of educational attainment (Benson, 1978). Cohn and Geske (1990) explained,

"since persons selected for an educational (or training) program possess the kinds of

attributes sought by employers, higher earnings are paid even if no productivity effect is

discernible" (p. 58). Although these alternative hypotheses do not discount human

capital as a legitimate economic theory, they do raise questions about its underlying logic

and its application to problems of educational significance.

Dreijmanis (1991) reviewed and discussed several major critiques of human capital theory from sociological, educational, and economic perspectives, including the inability of human capital researchers to attribute increases in productivity and earnings to education rather than to such factors as individual ability or intelligence. Contrary to the central assumption of human capital theory that increased educational attainment yields higher earnings, Dreijmanis (1991) pointed to alternative findings that indicated that as the demand for education expands and as increasing numbers of people pursue additional educational opportunities beyond high school, the economic returns associated with higher levels of education actually begin to decrease. Likewise, DeYoung (1989) explained that inflated levels of educational attainment and the resulting creation of an "overqualified" workforce may decrease salaries and wages rather than improve economic conditions in society. In a departure from human capital theory, he asserted that the completion of a high school or college degree may be more closely related to a student's ability to succeed in school than his or her likelihood of future productivity or financial success in post-graduate employment.

Another criticism of human capital theory is that individuals do not generally have access to accurate or complete data upon which to base their decisions about investments in education, including such information as the full cost of education (taking foregone earnings into account) or the potential for future earnings at various levels of educational attainment (e.g., high school diploma, associate's degree, bachelor's degree, or graduate degree) (DeYoung, 1989; Dreijmanis, 1991). To examine this criticism, McMahon and Wagner (1981) analyzed the accuracy of the expectations of first-year college students regarding their future earnings potential by gender, race, field of study,

and anticipated level of educational attainment (bachelor's, master's, doctoral, or professional). They found that students who were planning to pursue graduate studies had realistic expectations of attaining higher earnings in the future, even though they anticipated that their starting salaries upon graduation would not differ greatly from students who had attained only a bachelor's degree. In other words, students projected that the economic payoffs from their additional investments in education may not be immediately apparent, but would yield higher earnings over the course of their working lives. McMahon and Wagner (1981) also concluded that first-year college students had a fairly accurate sense of the relative differences in earnings across different career fields when their reported expectations were compared with actual salary data. Similarly, Paulsen (2001a) observed that students in higher education "appear to be reasonably careful and accurate in their acquisition of information about earnings differentials" (p. 63).

In his study of the economic benefits and costs that are associated with a fifth-year undergraduate teacher certification program, Lewis (1990) critiqued the use of human capital approaches in the study of teacher preparation, including the central issue of whether completion of a certification program is an accurate measure of future teacher productivity and performance in the classroom. In other words, the lack of consistent empirical evidence linking teacher preparation methods and models with teacher performance and student achievement raises questions about a fundamental assumption of human capital theory – that investments in education yield higher levels of productivity and higher levels of subsequent earnings. Likewise, Plecki (2000) pointed to inconsistent findings in the empirical research linking economic investments in teachers

to future performance in the classroom. Lewis (1990) also cited limitations related to the inability of economic frameworks to capture the nonmonetary benefits of education and observed that educational outcomes "have been assumed to be based upon achieving important social and educational values, dispositions, skills, and knowledge and, therefore, have been largely unmeasurable in monetary and economic terms. This is undoubtedly why many evaluators of teacher education have never attempted using this technique" (p. 26).

Nonetheless, human capital theory serves as the framework for studying a wide range of educational policies and issues, including the implementation of programs to prevent students from dropping out of high school, the long-term benefits of preschool education for economically disadvantaged children, college financial aid programs, and educational investments in developing countries (Levin, 1995a). However, only a limited number of examples in the research literature use a human capital approach to study teacher preparation programs and evaluate their benefits and costs to individuals and society. Multiple factors may contribute to the lack of research in this area. As explained by Lewis (1990) and Plecki (2000), the conceptual and empirical links between investments in teachers and the intended outcomes of these investments (including teacher effectiveness and student achievement) are often unclear and inconsistent in educational research studies. Researchers may be reluctant to measure the outcomes of investments in K-12 and higher education in economic terms, as the aims of such investments are seemingly nonmarket-oriented. Further, since teacher preparation programs are housed within individual higher education institutions, the broader economic value to communities and states is often unrecognized.

Despite these limitations, a human capital framework can make important contributions to our understanding of education and its value, impact, and role in American society. As Sweetland (1996) summarized, "There is an economic component to education: Education entails economic costs, and it provides individuals and society with benefits that are difficult to measure with economic certainty. The field of human capital theory provides an empirical framework that begins to measure these economic relationships" (pp. 356-357). Likewise, the development of a research framework that systematically identifies and evaluates the benefits and costs that are associated with a particular teacher education policy, program, or intervention can make important contributions to our understanding of the role of human capital in the preparation of future K-12 teachers.

Summary

This chapter reviewed the origins of human capital theory and its utility for measuring the benefits and costs of investments in education. In their seminal research in this field, University of Chicago economists Schultz (1963) and Becker (1964, 1975, 1993) formalized many of the concepts, assumptions, and methods of modern human capital theory and extended its use for exploring returns on economic investments in K-12 and higher education. Several areas of convergence emerged through this review of the literature: education is a form of economic investment with certain benefits and costs for individuals and society, the benefits of education are both monetary and nonmonetary, and future returns on investments in education appear to consistently exceed the cost of education. At the same time, however, questions about the application of human capital theory to issues of educational significance still remain, including the assignment of

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monetary values to educational returns, the potential for underestimating or disregarding the nonmarket-oriented benefits of education, and acceptance of the assumption that higher levels of educational attainment automatically lead to increases in productivity among individuals.

Despite these questions, human capital theory provides a useful lens for understanding the economic impact of education and its benefits and costs for both individuals and society. Over the past several decades, researchers have used a human capital perspective to examine returns to elementary education, secondary education, vocational education, higher education, and graduate education both in the United States and abroad. More recently, human capital research has extended into studies of specific student subpopulations, institutional types, and academic disciplines in order to gain a deeper understanding of the economic impact of educational programs and initiatives (Cohn & Geske, 1990; Kastner, 1977; Lewis, 1990; McMahon & Wagner, 1981; Plecki, 2000; Sanchez & Laanan, 1997). This study continues in this direction by focusing on a specific issue of significance in K-12 and higher education: teacher preparation. The shortage of qualified teachers in Maryland and other states has important economic consequences both now and in the future. The role of community colleges in teacher preparation warrants further investigation, as it represents a particular form of investment in human capital with benefits and costs for community college students, institutions, and the taxpayers who invest in these programs versus other alternatives, including teacher preparation programs at four-year institutions.

Human capital theory can provide an important set of perspectives for educators and policymakers as they evaluate the net benefits of various alternatives for preparing

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sufficient numbers of highly qualified college graduates to teach in the nation's classrooms. A review of the literature revealed few research studies that applied benefit-cost analysis or other human capital frameworks to the study of teacher preparation programs in higher education institutions. This study attempts to fill this void by providing a systematic framework for evaluating the economic benefits and costs that are associated with a particular model of community college involvement in teacher education in one state.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

This study uses benefit-cost analysis to compare the benefits with the costs of three alternative scenarios for Maryland community colleges in K-12 teacher preparation: (a) community colleges retain their traditional role in K-12 teacher preparation by providing lower-division transfer courses and programs (historical role for Maryland community colleges), (b) community colleges expand their traditional role by offering the AAT degree in addition to providing lower-division transfer courses and programs (current role for Maryland community colleges), and (c) community colleges offer the AAT degree as the lower-division requirement for students seeking admission into teacher preparation programs at four-year colleges and universities (hypothetical future role for Maryland community colleges). Using Gramlich's (1990) methods for conducting benefit-cost studies of human investment programs, this study examines the benefits and costs that are associated with each of these three scenarios.

Chapter 3 begins with an overview of the study's research design, a rationale for the selection of benefit-cost analysis, and a summary of the study's four research questions. It continues with a discussion of how the benefit-cost analysis is framed and a description of the three representative community college student categories that are used to weight the benefits and costs for each of the three policy alternatives. The chapter proceeds with a discussion of the benefit and cost categories and the data sources that are included in the analyses in each category. The chapter concludes with a discussion of the limitations of the research methodology and a chapter summary.

Research Design

This study is designed as a benefit-cost analysis consistent with Gramlich's (1990) approach to measuring returns from human investment programs to individuals and society. Benefit-cost analysis is an appropriate research method for this study since the three policy scenarios under consideration are all designed to increase a particular type of human capital investment—in this case, by developing opportunities for community college students to enter the state's K-12 teacher preparation pipeline. Benefit-cost analysis involves the systematic evaluation of program or policy alternatives by analyzing their benefits and costs in monetary terms (Levin & McEwan, 2000). Benefit-cost analysis incorporates a research framework that assesses the benefits and costs to individuals who are directly affected by the policy, individuals who are not directly affected by the policy (e.g., taxpayers), and society as a whole (the sum of these categories). The optimal policy alternative maximizes net benefits to society as a whole, not just to individuals who may directly benefit from the policy (Gramlich, 1990).

Rationale for the Selection of Benefit-Cost Analysis

The literature on the economics of education and human capital theory calls for the selection and use of research methods that identify the benefits and costs of alternative investments in education, that evaluate the worth of these investments, and that measure their long-term returns to individuals and society (Becker, 1964, 1975, 1993; Schultz, 1963). Benefit-cost analysis is an economic method that provides a rigorous framework for comparing alternative investments, and it requires that benefits and costs be allocated across key stakeholder groups that are affected by the policy. Benefit-cost analysis is often used to evaluate public sector programs that are designed to

produce effects on certain individuals or groups in society—some of whom may directly

benefit from the intervention, some of whom may only indirectly benefit, and some of

whom may not benefit at all (Cohn & Geske, 1990). According to Gramlich (1990),

benefit-cost analysis is a particularly useful method for measuring the impact of a policy

intervention that shifts or redistributes the allocation of resources, since it involves the

systematic comparison of benefit and cost categories across a range of stakeholder groups

and alternatives.

Benefit-cost analysis also allows for the accrual of future benefits. This is

important because the outcomes of policy interventions (particularly in education) are not

always immediate, but may unfold over an extended period, such as the course of an

individual's lifetime. Therefore, the findings in this study are presented in net present

value terms (the calculated difference between an intervention's benefits and costs over

time). The optimal investment decision among various alternatives is the one that

produces the greatest net value, or benefit, to society. In benefit-cost analysis, the

"maximum social gain" principle dictates that "prospective benefits must exceed

anticipated costs, and more importantly, the excess of benefits over costs must be

maximized" (Cohn & Geske, 1990, p. 95). While the results of benefit-cost studies are

often expressed in percentages as rates of return (the rate at which the net present value of

all benefits equals the net present value of all costs), I was interested in the actual dollar

values of these investments for Maryland students and taxpayers. Therefore, I opted to

use net present values as the unit for reporting the results of the benefit-cost analysis in

the current study.

Monetary and nonmonetary returns from education for both individuals and society have been a particular area of focus for human capital researchers over the past several decades (Becker, 1964, 1975, 1993; Bowen, 1977; Leslie & Brinkman, 1988; Mincer, 1974; Psacharopoulos, 1973; Schultz, 1963; Vaizey, 1962). Using a human capital framework, benefit-cost studies have examined the economic effects of various levels of educational attainment including preschool, elementary education, secondary education, two-year and four-year undergraduate education, graduate education, and occupation-specific programs such as vocational education and medical education (Cohn & Geske, 1990). Barnett (1985), for example, used benefit-cost analysis to study the long-term economic effects of participation in preschool programs among children from lower income families, while Lewis (1990) used benefit-cost analysis to compare the net present value of a fifth-year undergraduate teacher licensure program with two other alternatives. In addition to the analysis of specific programs, benefit-cost studies have also been conducted to study educational returns on aggregate levels. For example, Cohn and Hughes (1994) conducted a benefit-cost analysis of investments in higher education in the United States from 1969 to 1985, while Kastner (1977) applied benefit-cost analysis to examine individual and societal returns on investments in community college education in the United States in the 1970s.

As an alternative economic approach to benefit-cost analysis, cost-effectiveness analysis is often used in educational research and evaluation since it allows the benefits of a program or policy intervention to be measured in nonmonetary units or outcomes (e.g., the impact of a particular intervention on the numbers of teachers produced or on student achievement test scores). Cost-effectiveness analysis is a research framework

that determines which alternative maximizes the desired output at the lowest cost (Levin, 1995b; Rice, 1996). However, unlike benefit-cost analysis, cost-effectiveness analysis does not provide tools for systematically calculating the net present value of various policy alternatives or comparing the economic value of investments in one sector (e.g., education) with alternative investments in other sectors of society (e.g., physical capital investments such as buildings or roads, or other human capital investments such as healthcare services). Since the central focus of this current study is not economic efficiency, but rather the comparison of benefits and costs across policy alternatives to project which yields the greatest net benefit, benefit-cost analysis is a more appropriate research method for the study.

Overview of Benefit-Cost Analysis Methods and Procedures

Conducting a benefit-cost analysis of a policy or program involves three procedural steps: defining and measuring benefits, defining and measuring costs, and placing the benefits and costs into an appropriate framework for analysis and decision-making (Levin, 1995a). When using this methodology, both benefit and cost data must be quantified in monetary terms. Benefits are defined as the outcomes that are gained as a result of an intervention, and may accrue to individuals who are directly affected by the policy or program, or to other individuals who are either indirectly or not at all affected by the policy or program. Costs, on the other hand, are defined as the total value of resources that are given up by both participants and non-participants to support the policy or program. This concept is often referred to as "opportunity costs" in the economic literature. Opportunity costs assume that if the resources had not been used for the policy

intervention, they would have been used for some other alternative (Levin & McEwan, 2000).

Once benefit and cost data are collected, inventoried, and assigned monetary values, the next step of the benefit-cost analysis is to combine the benefits and costs into a framework for analysis and decision-making. This framework allows for the comparison of benefits and costs across various alternatives or choices (e.g., policies or programs, depending on the focus and scope of the study) to determine which yields the greatest net benefit to society as a whole. Benefits are generally discounted to reflect the time value of money, since policy interventions such as educational programs require resource investments in the present, and derive returns on these investments in the future. Discounting allows for the comparison of both benefits and costs in common monetary terms, and a net present value (the difference between the total benefits and total costs) can be derived for the policy intervention. In addition, sensitivity analyses are often conducted to see how the study's conclusions stand up to alternative projections and to a range of high, medium, and low data estimates.

After the study's four research questions are presented in the next section of this chapter, the discussion continues with a more detailed description of the development of this benefit-cost analysis framework, and the data sources and assumptions that are used in each of the benefit and cost categories in the study. Then, in Chapter 4, I develop a series of representative cases to account for the broad range of paths that community college students can potentially follow within the teacher education transfer pipeline, calculate the benefits and costs for each of these student cases using a common

framework, and apply the net present value data derived from these cases to an analysis of the three policy scenarios for the AAT degree in Maryland.

Research Questions

There are four research questions in this study. The first three questions address the economic benefits and costs that are associated with three different profiles of Maryland community college students in the teacher preparation transfer pipeline: those who follow an "optimal" pathway toward degree completion, those who follow a "typical" pathway toward degree completion, and those who leave the higher education pipeline altogether and do not complete a bachelor's degree leading to teacher certification. Using benefit-cost analysis, net present values are calculated for each of these representative categories of students, and sensitivity analysis is used to account for a range of post-graduate outcomes, including future employment both inside and outside of the K-12 teaching profession, and future employment both inside and outside of Maryland. Then, the fourth research question in the study applies the benefit-cost data from the first three questions to a broader framework to analyze three alternative scenarios for the AAT degree in Maryland community colleges, including an historical scenario, a current scenario, and a hypothetical future scenario. Thus, the study's four research questions are framed as follows:

1. What economic benefits and costs are associated with optimizing the transfer student pipeline in teacher preparation between Maryland community colleges and four-year institutions? What is the net present value of an "optimal completer" in Maryland?

2. What economic benefits and costs are associated with the typical transfer

   student pipeline in teacher preparation between Maryland community colleges

   and four-year institutions? What is the net present value of a "typical

   completer" in Maryland?

3. What economic benefits and costs are associated with non-completers in the

   transfer student pipeline in teacher preparation between Maryland community

   colleges and four-year institutions? What is the net present value of a "non-

   completer" in Maryland?

4. What is the relative economic value of each of the following three policy

   scenarios for Maryland community colleges in teacher preparation:

a) Maryland community colleges retain their traditional role in teacher

   preparation by providing lower-division transfer courses and programs

   (historical role for Maryland community colleges);

b) Maryland community colleges expand their traditional role by offering the

   AAT degree in addition to providing lower-division transfer courses and

   programs (current role for Maryland community colleges); and

c) Maryland community colleges offer the AAT degree as the lower-division

   requirement for students seeking admission into teacher preparation programs

   at four-year colleges and universities (hypothetical future role for Maryland

   community colleges)?

Optimal Completer, Typical Completer, and Non-Completer Case Categories

One of the challenges that is associated with the benefit-cost analysis in the

current study is that it conjectures about the future based on past and present data in such

areas as student enrollment trends, choice of academic program, transfer and persistence patterns, likelihood of degree attainment, and employment outcomes. Although Maryland community college AAT programs graduated their first students in 2003, there are still limited statewide data upon which to differentiate the longitudinal outcomes of this program from traditional community college transfer courses and programs in teacher education, in the absence of a statewide longitudinal data system, or any comprehensive pipeline studies of the AAT program to date. Since the majority of Maryland community college students attend college part-time (MHEC, 2005a), there is a long time horizon when tracking these students from initial enrollment, through transfer and degree completion, and into the workforce. While community college student enrollments and degrees are tracked by standard Classification of Instructional Program (CIP) codes at the institutional and state higher education agency levels in Maryland, no comprehensive, statewide study has been completed to date that has followed community college teacher education students (enrolled in the AAT or in traditional transfer programs) into four-year institutions or into teaching positions. Thus, the data in this study are derived from analyses of a more limited scope that have examined the progression of AAT students. Without a statewide education longitudinal data system (which is discussed in further detail in Chapter 5 as a limitation of this study), analyses and forecasts prove challenging for researchers due to the existing lack of data coordination across education segments.

In order to supply the background data that are needed to address the study's three research questions, benefits and costs are first calculated for three representative categories of community college students. These three categories were developed as

hypothetical representations in order to capture the broad range of potential outcomes among community college students in the teacher education pipeline (e.g., completing an associate's degree versus not completing an associate's degree, transferring to a four-year institution versus not transferring to a four-year institution, completing a bachelor's degree versus not completing a bachelor's degree, pursuing a teaching job in Maryland versus not pursuing a teaching job in Maryland). Without these representative categories in place, the potentially infinite range of student outcomes would simply have been too vast to capture within the scope of this benefit-cost study. In order to test the accuracy of my assumptions about these three representative student categories, I reviewed them with the Associate Vice Chancellor for Academic Affairs at the University System of Maryland (USM), who is the leading state officer for issues related to student transfer and articulation. I also compared these categories against a student transfer pipeline template that was developed by the Director of Policy Research and Analysis at USM, and found them to be consistent with the construction of the student transfer pipeline that was developed for that analysis.

In this benefit-cost study, community college students who enter the teacher education pipeline, whether via the AAT or via a traditional AA transfer program, are placed into one of three categories: "optimal completer," "typical completer," or "non-completer." The optimal completer case is a hypothetical Maryland community college student who completes each portion of the educational pipeline in the most efficient timeframe possible and maximizes the benefits stream to society (State of Maryland) after graduation. This student enrolls in the AAT or AA transfer program and completes the associate's degree in two years. Immediately thereafter, the student transfers to a

four-year public or independent institution in Maryland, enters an education major, and completes the bachelor's degree in two years. Four streams of future income benefits (discounted) are considered for the optimal completer case: maximum returns to teaching, expected returns to teaching, alternate returns to teaching, and no returns to teaching. Maximum returns assume career-long service as a Maryland teacher, expected returns assume some length of service as a Maryland teacher, alternative returns assume employment outside of teaching for some length of time in Maryland, and no returns assume no employment or employment exclusively outside of Maryland. In determining benefits for the optimal completer, an earnings income premium is calculated to reflect the economic value of the employment outcome associated with attaining the bachelor's degree versus having a high school diploma alone. The data assumptions and calculations for each of these categories of returns are explained in further detail in Chapter 4.

In comparison, the typical completer case is a hypothetical Maryland community college student who follows the more typical path of community college students in the state's educational pipeline who eventually attain a bachelor's degree. In this example, the student still completes each portion of the educational pipeline. However, his or her enrollment and employment patterns reflect the actual rate at which students typically progress through this two-year to four-year pipeline. The same discounted income benefit streams are calculated for both optimal completers and typical completers in the pipeline (maximum returns, expected returns, alternate returns, and no returns), as a premium over what would have been earned with a high school diploma.

Whereas both the optimal completer and typical completer cases progress through the entire educational pipeline through receipt of a bachelor's degree, the non-completer case is assumed to exit this pipeline prematurely. Students who fall within this category include community college students who exit the pipeline by moving into another field (outside of education) at either the associate's or bachelor's degree level, by dropping out of a Maryland community college prior to degree completion, by not transferring to a Maryland public or independent four-year institution, or by dropping out of a Maryland public or independent four-year institution prior to degree completion. Unlike the optimal completer and typical completer cases, the non-completer case is not assumed to bring any returns directly to teaching, since students in this category have not attained the necessary level of education (i.e., minimum of a bachelor's degree) to enter this career field at the level of a professionally certified teacher. However, alternate returns to teaching are included in the calculation of benefits for each variation of the non-completer case, since students are assumed to earn a future earnings premium that is commensurate with their level of educational attainment over the completion of a high school diploma.

Economic benefits and costs are then inventoried and calculated for these three representative categories of community college students (optimal completer, typical completer, and non-completer) in order to arrive at a net present value for each case. The benefits under consideration include a future income earnings premium and state tax revenues (associated with the student's level of educational attainment beyond a high school diploma, adjusted to account for a range of post-graduate outcomes, and discounted to present value terms), while the costs under consideration include tuition

and fees, books and supplies, state subsidies to higher education, financial aid, and

foregone earning and taxes. (These benefit and cost categories, data sources, and

calculations are explained in detail later in this chapter.) These analyses address the first

three research questions in the study, which pertain to the economic benefits and costs

that are associated with optimal, typical, and non-completion pathways for community

college students in the state's teacher preparation transfer pipeline. Once individual net

present values are calculated for the optimal, typical, and non-completer cases, a series of

projections are made to examine the extent to which the AAT and the traditional transfer

programs in education, by their design and implementation, affect the number and

distribution of optimal, typical, and non-completer cases across the three policy

alternatives under consideration in the study (historical, current, and future). These

analyses address the study's fourth research question.

Framing the Analysis

While the three policy scenarios in this study represent three different roles for

Maryland community colleges in teacher education at three different points in time

(historical, current, and future), the policies themselves are actually interrelated. Rather

than existing as mutually exclusive, non-overlapping alternatives, these three scenarios

exist along a continuum of policy options. The relationship among these three scenarios

is represented in Table 1.

Table 1
Continuum of the Three Policy Scenarios

Policy Components	Scenario 1 Historical	Scenario 2 Current	Scenario 3 Hypothetical Future
(1) Teacher Preparation Transfer Courses and Programs	X	X	
(2) AAT		X	X

In the first policy scenario under consideration in this study, community colleges retain their traditional role in teacher preparation by providing lower-division transfer courses and programs for students seeking admission into teacher preparation programs at four-year colleges and universities. This represents the historical role for Maryland community colleges in preparing K-12 teachers. In the second policy scenario under consideration in this study, community colleges expand their traditional role by offering the AAT degree in addition to continuing to provide lower-division transfer courses and programs in education. This represents the current "blended" role for Maryland community colleges in preparing K-12 teachers. In the third policy scenario under consideration in this study, community colleges would offer the AAT degree as the exclusive lower-division requirement for students seeking admission into teacher preparation programs at four-year colleges and universities. Thus, the AAT would become the sole transfer pathway into a teacher education program at a four-year institution in Maryland. This represents the hypothetical future role for Maryland community colleges in preparing K-12 teachers.

Given this framework, there are several potential approaches for structuring the benefit-cost analysis in this study. For example, one could run the analysis at three

different points in time (e.g., using the 1994-1995 academic year for the historical

scenario, the 2004-2005 academic year for the current scenario, and the 2014-2015

academic year for the predicted future scenario). Benefits and costs could be reported in

constant dollars in order to adjust for the effects of inflation across the three scenarios.

While possible, this approach has several shortcomings. First, one would not have equal

access to accurate data across the three scenarios. While data are available pertaining to

the historical scenario since it has been in place in the State of Maryland for a number of

years, the current scenario is still unfolding, and the future scenario has yet to occur.

Second, the time intervals selected for comparison (i.e., 1994-1995, 2004-2005, and

2014-2015) are somewhat arbitrary. Third, this approach would violate many of the

fundamental assumptions of benefit-cost analysis, a method that is designed to help

policymakers compare future benefits to present costs across various alternatives.

Rather than structuring this study as suggested above, I decided that a more valid

approach would be to construct a student cohort pipeline analysis, positioning all three

scenarios in the same start year to determine what would have happened if each of the

three scenarios had been in place in Maryland. Following single student cohorts for

longitudinal analysis is a well-established method in the educational research literature,

particularly when examining educational outcomes related to particular groups of

students. (See Adelman (1999), for example.) The major advantage to this approach is

that it relies less on future projections and allows for a more accurate comparison of the

three scenarios using readily available data. Moreover, it directly follows Gramlich's

(1990) recommended methodology of benefit-cost analysis by laying out options in a

framework that compares costs incurred in the present with benefits incurred in the

future. Therefore, in line with this approach, the benefit-cost analysis in this study is situated with the 2004-2005 academic year serving as the baseline. Since college graduation rates are typically calculated in four-year and six-year intervals, I positioned the study so that a minimum of six years of state-level enrollment and degree trend data would be available to include in the analysis.

Benefit and Cost Categories in the Analysis

Table 2 summarizes the benefits and costs that are included in the study. Benefits and costs are also allocated across two stakeholder groups: program participants (Maryland community college students in the teacher education transfer pipeline) and non-participants (Maryland taxpayers). This framework is based on Gramlich's (1990) model for cataloguing and analyzing benefit and cost data for education-related human investment programs. This model also acknowledges that higher education can be viewed both as a public and private benefit, a concept that will be discussed in further detail in Chapter 5. (See Bowen (1977) for a related discussion.) Following Table 2, I describe the benefit and cost categories in the study in greater detail and discuss the data, assumptions, and analyses that each category requires. Using the framework in Table 2, economic benefits and costs are calculated for the three representative groups of students in the study (optimal completers, typical completers, and non-completers), to arrive at a net present value for each in Chapter 4. These analyses address the first three research questions in the study. The data from the study's first three research questions are then used to address the study's fourth research question by projecting the potential distribution of students from these categories under each of the three policy alternatives for the AAT degree in Maryland (historical, current, and future).

Table 2
Benefit and Cost Categories in the Study

Benefits and Costs	Program Participants (Students) (1)	Non-Participants (Taxpayers) (2)	Society (Net) (1+2)
Benefits Premium			
Future Income (Teaching and/or Alternate)	X		X
Future Taxes		X	X
Total Benefits	X	X	X
Educational Costs			
Tuition and Fees	X		X
Books and Supplies	X		X
State Subsidy		X	
Financial Aid	-X	X	
Foregone Earnings	X		X
Foregone Taxes		X	X
Total Costs	X	X	X
Net Present Value	X	X	X

Future Income and Taxes

In determining benefits, an earnings "premium" is calculated to reflect the economic value of the future income that is associated with the student's level of attainment within the teacher preparation pipeline (i.e., college attendance without an earned college degree, with an earned associate's degree, or with an earned bachelor's degree) versus having a high school diploma alone. In calculating this premium, all projected earnings in the study are measured against the median annual earnings for fully employed high school graduates (with no college attendance or no college degree), as reported in the *Current Population Survey* (U.S. Bureau of the Census, 2008). The baseline for teaching income is derived from MSDE's (2008b) professional salary schedules for Maryland teachers in elementary and secondary public schools. For the purposes of this study, teachers are assumed to begin their first year of employment in 2008-2009 at the statewide average starting salary rate for bachelor's degree recipients with a standard professional certificate.

In Chapter 4, teaching span (i.e., length of career service in teaching) is calculated at several intervals, and alternatives to employment in teaching are also considered, using earnings data from the National Association for Colleges and Employers (NACE) (2008) annual *Salary Survey* of bachelor's degree recipients and the *Current Population Survey* (U.S. Bureau of the Census, 2008). Where applicable, salary adjustments are made to account for gender (given gender disparities both in earnings and in the composition of the teacher preparation pipeline), workforce participation expectancy (the duration of which differs by gender and by level of educational attainment), and post-graduate migration to other states. Earnings for both teachers and non-teachers in the study are

assumed to increase at an average rate of 4% per year. Future earnings are discounted at 4%, and a Maryland state tax rate of 7.57% is applied to the discounted income stream.

Tuition and Fees

Statewide average tuition and fee rates, weighted by student enrollment and including only those institutions with undergraduate teacher preparation programs, are used for each segment of higher education that is represented in the study—community colleges, four-year public institutions, and four-year independent institutions (MHEC, 2006a, 2007a, 2008b, 2009a). Actual tuition and fee data are used for each segment in FY05, FY06, FY07, and FY08; subsequent tuition and fee increases are projected for case calculations that fall outside of this four-year fiscal timeframe. Where applicable, tuition and fee data are weighted by student enrollment status (full-time versus part-time attendance) as well as the likelihood of a Maryland community college student transferring to a four-year public institution versus a four-year independent institution.

Books and Supplies

Annual costs for books and supplies are derived from national averages reported by the College Board (2004) for undergraduate students attending two-year and four-year institutions in FY05. The cost calculations assume an inflationary factor of 4% applied each year thereafter (beyond FY05), which was the prevailing Consumer Price Index inflation rate in October 2005.

State Subsidy

Each year, the State of Maryland provides financial subsidies to Maryland community colleges, four-year public institutions, and eligible four-year independent

institutions via the General Fund. These subsidies, the amounts of which are annually

determined by the Maryland General Assembly, are calculated per full-time equivalent

(FTE) enrolled student and granted directly to higher education institutions. The state's

four-year public colleges and universities receive the highest per-student subsidy,

followed by community colleges and four-year independent institutions. State subsidy

data for FY05 are used as the first-year baseline in the study, and are subsequently

apportioned according to projected level of student enrollment in the pipeline (MACC,

2006, 2007; MHEC, 2008b, 2009a).

Financial Aid

The financial aid data in this study are based on average annual financial aid

packages among undergraduate student recipients in Maryland two-year and four-year

public and independent institutions (MHEC, 2006b, 2007c, 2008c, 2009c). These

financial aid figures include grants, scholarships, and work study awards from federal,

state, institutional, and private sources. Loans are excluded from the analyses in the

study since students must repay them in the future. Financial aid data are weighted by

the likelihood of a student being an aid recipient and by the likelihood a student attending

a four-year public or four-year independent institution upon transfer from a Maryland

community college. To avoid the overestimation of financial aid costs to taxpayers,

additional weights are applied to subtract out the projected portion of institutionally-

awarded financial aid (in the form of institutional grants and institutional scholarships)

that is state-supported, and therefore would already be accounted for in the state subsidy

cost category in the benefit-cost analysis. In this study, financial aid costs are considered

to be an internal transfer payment between Maryland taxpayers and students in the pipeline.

Foregone Earnings and Taxes

Foregone earnings are based on the assumption that if students were not enrolled in school, they would be gainfully employed in the workforce and generating tax revenue for society, in addition to earning income for themselves (Schultz, 1963). Estimates place foregone earnings at two-thirds to three-fourths of the total cost of four years of undergraduate college attendance (Paulsen, 2001b). The inclusion of foregone earnings to assess the full opportunity costs of education has been criticized in the human capital literature (Vaizey, 1962). However, since the inclusion of foregone student earnings is supported by Schultz (1963) and Becker (1964, 1975, 1993) and addressed in Gramlich's (1990) model for assessing the benefits and costs of human investment programs, foregone earnings and taxes are assigned as cost categories in this current study.

To calculate expected foregone earnings during college attendance, this study uses 2004 annual median earnings data by gender and race for individuals ages 25 and over in the workforce with a high school diploma but no college degree (Bureau of the Census, 2004a, 2004b). These national salary data are adjusted to account for community college student age as well as the projected distribution of males and females in the educational pipeline in the study. Since these earnings data likely overestimate the costs of foregone earnings and taxes (since many students work while enrolled in college, thereby offsetting their loss in earnings to some degree), undergraduate student employment data for 2004-2005, reported by the National Center for Education Statistics (NCES), are used to estimate the extent to which expected foregone salary and tax data

should be reduced to account for student employment earnings (Aud, Hussar, Kena, Bianco, Frohlich, Kemp, & Tahan, 2011). Using these data, the full foregone earnings costs in the study are reduced to account for the likelihood of a student working while attending college, as well as the average number of hours worked per week while enrolled (adjusted for full-time or part-time college attendance). The expected foregone earnings calculations in this study assume an average annual increase of 4% and an unemployment rate of 5.5%, which was the average national unemployment rate during 2004-2005 (Bureau of Labor Statistics, 2005). A Maryland state tax rate of 7.57% is applied to the foregone earnings stream.

Methodological Limitations

Benefit-cost analysis is a research method that requires the reporting of benefit and cost data in monetary terms. This is a potential limitation when intended policy outcomes extend beyond market-oriented benefits (such as increased productivity or earning power) into nonmonetary returns (such as increased satisfaction or quality of life). Nonmonetary returns to individuals from investments in higher education, including such lifelong benefits as better health and working conditions, have been shown to far exceed the monetary returns (Bowen, 1977). Dunn and Sullins (1982) asserted that many of the important societal benefits of higher education, including research, public service, auxiliary enterprises, and contributions to economic stability and civic responsibility, tend to be either undervalued or overlooked in benefit-cost analysis studies because they are difficult to monetize. Levin (1995a) likewise asserted that monetary benefits "will understate the true value of benefits from educational investments" (p. 361). Thus, benefit-cost analysis is most appropriate to use when policy

benefits can be converted into monetary values or when those that cannot be monetized are either minor in the total scope of the analysis or are constant across the various policy alternatives under consideration (Levin & McEwan, 2000). Since benefit and cost data in this current study are limited to what can be measured in monetary terms, this research approach could very likely underestimate the full benefits and costs of each policy alternative under consideration.

Another methodological limitation related to benefit-cost analysis is that it requires researchers to make assumptions in instances where reliable data upon which to base benefit and cost estimates are unavailable. Levin and McEwan (2000) cautioned that "uncertainty often stands to alter the fundamental conclusion of a cost analysis" (p. 100). In such cases, researchers must use proxies (such as the fair market value of an item or service), select a mean figure from a range of values, or make projections based on existing information. To reduce the implications of this limitation, sensitivity analysis is often used in benefit-cost analysis to test a range of alternative assumptions, and to determine the extent to which the results of the benefit-cost analysis are sensitive to changes in benefit and cost data and other input variables.

Gramlich (1990) asserted that benefit-cost analysis should be viewed as one of many inputs into a policy decision, and not as the policy decision in and of itself. Although this study involves the comparison of three policy alternatives to determine which shows the greatest net benefit, the chosen alternative via benefit-cost analysis may not be the optimal one for implementation. While benefit-cost analysis can provide policymakers with data about the advantageous allocation of resources, without additional non-monetary data to consider, the method may not adequately account for

other issues, such as program quality, that are also important in policy decisions. For example, while investments in community college teacher preparation programs may help increase student transfer and completion rates, resulting in a larger pool of qualified teachers in Maryland (and greater returns to taxpayers on their educational investment via state subsidies to higher education and financial aid support), it may not necessarily result in corresponding increases in the quality or effectiveness of these teacher candidates, or their longevity in the teaching profession.

Despite these limitations, this study, through the use of benefit-cost analysis, provides a systematic approach for assessing the economic benefits and costs of various investments in community college teacher preparation programs in Maryland. This analysis will inform Maryland and potentially other states about the relative benefits and costs of the three alternatives in the study, and their impact on key stakeholder groups, to project which yields the greatest net benefit to society.

Summary

Using benefit-cost analysis, this study examines three alternative policy scenarios for community colleges in K-12 teacher preparation in the State of Maryland. Chapter 3 provided an overview of the methodology of the study, including the creation of three representative groups of Maryland community college students (optimal completers, typical completers, and non-completers), in order to capture the broad range of potential student outcomes in the teacher preparation transfer pipeline. Chapter 3 also provided an explanation of the benefit and cost categories and data sources that are included in the study, which are consistent with Gramlich's (1990) approach to conducting benefit-cost analyses of human investment programs. In Chapter 4, these benefit and cost data will be

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used to calculate a net present value for each representative student category (addressing

Research Questions 1, 2, and 3), and to project the potential distribution of pipeline

participants under each of the three policy alternatives in order to evaluate the relative

economic value of each (addressing Research Question 4).

CHAPTER 4

RESULTS OF THE STUDY

This chapter presents the results of the benefit-cost analysis for each of three alternative policy scenarios for the role of Maryland community colleges in teacher preparation. First, economic benefits and costs are calculated for three representative categories of community college students in the state's higher education pipeline: optimal completer cases, typical completer cases, and non-completer cases. Using the framework from Table 2 in Chapter 3, benefits and costs are presented in economic (i.e., monetary) terms for each of these three student categories, and net present values are calculated for each. These analyses address the study's first three research questions. The net present values derived from the first three research questions are then used to weigh the relative economic value of each of the three policy scenarios (historical, current, and hypothetical future) for Maryland community colleges. These analyses address the study's fourth research question.

All analyses in this study are situated with the 2004-2005 academic year (or 2005 fiscal year, where applicable) serving the baseline year. This timeframe was chosen in order to maximize the availability of longitudinal student pipeline data from which to make various economic projections and calculations in the study. Since four-year college graduation rates are typically calculated in six-year intervals, I positioned the study so that a minimum of six years of historical trend data would be available for the analysis.

Research Question 1: Optimal Completer Case

The first research question considers the economic benefits and costs that are associated with optimizing the transfer student pipeline in teacher preparation between Maryland community colleges and four-year institutions. Using the benefit-cost framework from Table 2 in the previous chapter, Table 3 documents the benefits and costs for one representative "optimal completer" in the study. This hypothetical student enrolls in an AAT or AA transfer program in a Maryland community college, completes the associate's degree in two years, immediately transfers to a four-year public or independent institution in Maryland, enters an education major, completes the bachelor's degree in two years, immediately takes a teaching job in a Maryland school, and spends his or her entire career teaching in Maryland. This hypothetical student case is designed to represent *maximum efficiency* in the two-year to four-year teacher education pipeline, as well as *maximum returns* to the State of Maryland through career service as a teacher.

Tables 4 and 5 present variations of the optimal completer case in Table 3 with adjustments to the benefits stream that reflect a range of post-graduate outcomes: benefits that reflect *expected returns* to the Maryland teaching workforce from this student (i.e., based on the average time that college graduates spend in the teaching profession), and benefits that reflect *alternate returns* to the Maryland teaching workforce from this student (i.e., assuming that some graduates in this pipeline will hold employment outside the teaching field). Based on labor market data, future income figures are weighted by the likelihood of graduates remaining employed in the workforce and remaining in the State of Maryland to live and work over time. Table 6 presents yet another variation of the optimal completer case, reflecting *no returns* to the Maryland workforce (i.e.,

assuming that some percentage of graduates in this pipeline will leave the State of

Maryland altogether to pursue post-baccalaureate employment, either in teaching or in an

alternate career field). Data sources and calculations for the benefits and costs that are

associated with these four variations of the optimal completer case are explained in detail

after Tables 3 through 6 are presented.

Table 3
Benefits/Costs for the Optimal Completer Case: Maximum Returns to Teaching

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income	845,361		845,361
Future Alternate Income			
Future Taxes		63,994	63,994
Total Benefits	845,361	63,994	909,355
Educational Costs			
Tuition and Fees	24,743		24,743
Books and Supplies	3,323		3,323
State Subsidy		20,226	20,226
Financial Aid	-8,867	7,005	-1,862
Foregone Earnings	63,143		63,143
Foregone Taxes		4,780	4,780
Total Costs	82,342	32,011	114,353
Net Present Value	763,019	31,983	795,002

Table 4

Benefits/Costs for the Optimal Completer Case: Expected Returns to Teaching

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income	299,443		299,443
Future Alternate Income	693,032		693,032
Future Taxes		52,894	52,894
Total Benefits	992,475	52,894	1,045,369
Educational Costs			
Tuition and Fees	24,743		24,743
Books and Supplies	3,323		3,323
State Subsidy		20,226	20,226
Financial Aid	-8,867	7,005	-1,862
Foregone Earnings	63,143		63,143
Foregone Taxes		4,780	4,780
Total Costs	82,342	32,011	114,353
Net Present Value	910,133	20,883	931,016

Table 5

Benefits/Costs for the Optimal Completer Case: Alternate Returns to Teaching

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income			
Future Alternate Income	1,066,032		1,066,032
Future Taxes		56,796	56,796
Total Benefits	1,066,032	56,796	1,122,828
Educational Costs			
Tuition and Fees	24,743		24,743
Books and Supplies	3,323		3,323
State Subsidy		20,226	20,226
Financial Aid	-8,867	7,005	-1,862
Foregone Earnings	63,143		63,143
Foregone Taxes		4,780	4,780
Total Costs	82,342	32,011	114,353
Net Present Value	983,690	24,785	1,008,475

Table 6

Benefits/Costs for the Optimal Completer Case: No Returns to Teaching

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income			
Future Alternate Income	1,066,032		1,066,032
Future Taxes			
Total Benefits	1,066,032		1,066,032
Educational Costs			
Tuition and Fees	24,743		24,743
Books and Supplies	3,323		3,323
State Subsidy		20,226	20,226
Financial Aid	-8,867	7,005	-1,862
Foregone Earnings	63,143		63,143
Foregone Taxes		4,780	4,780
Total Costs	82,342	32,011	114,353
Net Present Value	983,690	-32,011	951,679

Calculation of Benefits for the Optimal Completer Case

In Table 3, which represents maximum returns to teaching, the benefits category of future teaching income assumed a 33-year income stream. This figure was derived using the Gamboa Gibson Worklife Table, which reported an average worklife expectancy of 36.9 years for 25 year-old males and 31.5 years for 25 year-old females with an earned bachelor's degree in the United States, using data from the U.S. Bureau of the Census (Sidlow & Vega, 2010). "Worklife expectancy," or how long one is expected to work over the course of one's lifetime, is a statistical average, expressed in years, that is calculated as a sum of the joint probabilities of life, workforce participation, and employment (Sidlow & Vega, 2010). In order to arrive at an average worklife expectancy rate for the current study, I weighted the national figures presented in the Gamboa Gibson Worklife Table by the gender demographics of the Maryland public school teaching workforce, which was 23% male and 77% female in 2008, and has been relatively stable over time (MSDE, 2008a). I assumed that the higher education pipeline in teacher education would mirror the gender demographics of the teaching workforce over time, although data for Maryland-prepared teacher candidates from the previous academic year (2006-2007) were slightly more skewed toward females, at 81% (MSDE, 2008a). These calculations yielded an average workforce expectancy of 33 years ((36.9 years x .23 for males) + (31.5 years x .77 for females)), which then served as the length of the future benefits stream for optimal completers in Table 3.

In examining the potential fit of this figure into the benefit-cost model, 33 years exceeds the state's minimum service requirement of 30 years, the point at which teachers are generally eligible to separate and draw retirement benefits without penalty through

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the Maryland State Retirement and Pension System. At the same time, however, workforce data show that many Maryland teachers stay in the profession well beyond the 30 year service requirement—with approximately 8% of the state's 60,000 public school teachers in 2007-2008 having 30 or more years of teaching experience (MSDE, 2008a). Therefore, I decided that 33 years was a reasonable estimate for calculating the benefits stream for maximum returns to teaching among optimal completers with career service as a teacher.

The baseline year for the salary calculations in Table 3 was set during the 2008-2009 school year (assuming that students in this pipeline began their college studies during the 2004-2005 school year and graduated with a bachelor's degree following the 2007-2008 school year). The baseline salary was the statewide average Step 1 starting salary for Maryland public school teachers holding a bachelor's degree and a standard professional certificate, from MSDE's (2008b) *Professional Salary Schedules*. In these calculations, the starting salary was $42,537 in 2008-2009, and the salary stream was projected to end 33 years later with a salary of $149,222 in 2040-2041, assuming an annual salary increase of 4%. Four percent was the state's average annual salary increase for beginning public school teachers over the five-year period between 2003 and 2008 (MSDE, 2008c). A discount rate of 4% was applied to all future earnings, consistent with benefit-cost methodologies employed Gramlich (1990), as well as Maryland-specific studies including Clinch and Gerlowski's (2002) study of the economic impact of USM, and Christophersen and Robison's (2003) study of the economic impact of Maryland's 16 community colleges. Four percent was selected as the discount rate since it was the October 2005 inflation rate per the Consumer Price Index, and it was used for other

inflationary benefit and cost calculations in the study. Reflecting the time value of money, these adjustments decreased the 33-year income stream from a total of $2,816,355 (undiscounted) to $1,403,721 (discounted).

Since benefits calculations in human investment benefit-cost studies are tied to the level of education attained (in this case the bachelor's degree) versus all potential benefits (which the program participant would have otherwise accrued, for example, with a high school diploma or associate's degree), further adjustments were required for the income stream in Table 3. Namely, a future income "premium" was calculated to reflect the true value of the educational benefit under consideration, which, in this case, was the difference between future income that was projected to accrue from earning a bachelor's degree versus earning a high school degree. In order to make these adjustments, I considered the median annual earnings for fully employed high school graduates (with no college attendance or no college degree) ages 25 and older in the United States in 2008, which was $39,010 for males and $28,380 for females, according to the *Current Population Survey* (U.S. Bureau of the Census, 2008). Adjustments were then made to these salary figures to account for student age, since the reported median annual earnings for individuals ages 25 and older (who presumably represent a wide range of points in their careers) would likely over-predict the starting salary for recent high school graduates.

According to estimates in the 2008 *Current Population Survey* earnings patterns for workers ages 16 to 24 (a more suitable range for predicting the earnings of recent high school graduates), males on average could be expected to earn 54% of the ages 25 and over median salary figure, while females on average could be expected to earn 63% of

the ages 25 and over median salary figure (U.S. Bureau of the Census, 2008). From these

figures, I derived salary estimates of $21,065 for males ages 16 to 24 ($39,010 x .54) and

$17,879 for females ages 16 to 24 ($28,380 x .63). In order to account for the gender

imbalances in the educational pipeline in the study, one additional assumption was

factored into the future earnings calculations. Drawing on the demographic data of

professional teaching staff in Maryland public schools (MSDE, 2008a), 23% of the

community college students in the educational pipeline were predicted to be male and

77% were predicted to be female. Applying these additional weights to the salary figures

above yielded a blended starting salary rate of $18,612 for high school graduates

(($21,065 x .23 for males) + ($17,879 x .77 for females)).

In order to calculate the duration of the future benefits stream for high school

graduates, I once again utilized the Gamboa Gibson Worklife Table, which reported an

average worklife expectancy of 34.1 years for 25 year-old males and 28.3 years for 25

year-old females with a high school diploma in the United States (Sidlow & Vega, 2010).

In order to arrive at a blended average worklife expectancy rate for high school graduates

in the current study, I weighted the national figures presented above by the gender

demographics of the Maryland public school teaching workforce (assuming that they

would closely mirror the gender demographics of the teacher preparation pipeline), which

yielded an average workforce expectancy of 30 years ((34.1 years x .23 for males) +

(28.3 years x .77 for females)). These calculations yielded a 30-year benefits stream for

high school graduates beginning at $18,612 in 2008-2009 and ending at $58,044 in 2037-

2038, assuming an annual salary increase of 4%. When applying a discount rate of 4% to

all future earnings, the 30-year total income stream went from $1,043,853 (undiscounted)

to $558,360 (discounted). Taking the difference between the discounted income stream

for bachelor's degree recipients ($1,403,721) under this scenario and the discounted

income stream for high school graduates ($558,360), the total earnings premium for

maximum returns to teaching for the optimal completer was calculated at $845,361 in

Table 3.

Since the focus of this study is on the undergraduate education pipeline for

teacher preparation in Maryland, only those future benefits (i.e., salaries and tax

revenues) accruing from the receipt of the bachelor's degree are considered in the

analysis. Thus, one could reasonably assume that the projected revenue stream in this

benefit-cost analysis would actually under-predict future salary earnings for teachers in

the pipeline who go on to acquire additional education beyond the bachelor's degree, or

who advance into educational administration positions. (Likewise, it would under-predict

future earnings for individuals in the pipeline who pursue employment outside of

teaching and acquire additional education beyond the bachelor's degree.) All practicing

public schools teachers in Maryland are required to participate in continuous professional

development and learning beyond the bachelor's degree, in order to maintain licensure,

which often includes graduate-level coursework. In fact, 46% of all certified professional

staff working in Maryland public schools held a master's degree or higher during the

2004-2005 school year (MSDE, 2004a). While the assumption of an annual earnings

increase of 4% was built into the benefits calculations in this analysis, salary progression

may not occur as uniformly in actuality, as teachers progress through various salary steps

at different points in their careers. Again, the benefits in this study focus on returns to the

bachelor's degree versus higher levels of educational attainment, and I acknowledge that

these limits may actually under-predict the projected future earnings of both teachers and

non-teachers in the pipeline.

In calculating the revenue stream from taxes on the future income earnings

premium presented in Table 3, an aggregate rate of 7.57% was applied, which included

the state's income tax rate of 4.75% in 2008 (assuming a taxable net income range of

$3,000 to $150,000) and a statewide average local income tax rate of 2.82% (Comptroller

of Maryland, 2008). A statewide average rate was used for local income taxes since

Maryland county officials set these individual rates, which ranged from 1.25% to 3.20%

during the 2008 tax year. As shown in Table 3, the total revenue from state taxes that

could be expected from the $845,361 future benefits stream was $63,994.

Table 4 represents the scenario in which the hypothetical optimal completer

finished each portion of the two-year to four-year teacher education pipeline and

graduated, entered teaching for a specified period of time in Maryland, and then moved

from teaching into an alternate career field. The calculation of the benefits stream for this

case variation required an approximation of longevity in teaching. Nationally, only 50%

to 60% of beginning teachers remain in the teaching profession for over five years

(AASCU, 2005). In an exploratory study of USM education majors who completed their

teaching internships in a Professional Development School, graduated from college in

2004, and entered teaching in a Maryland public school, 71% were found to be teaching

one year later in 2005, and 75% two years later in 2006 (Jacob France Institute, 2007).

While MSDE does not calculate or publish statewide retention rates for entering cohorts

of new teachers, it does report annual attrition statistics by years of teaching experience

in Maryland public schools, reported in increments of less than 1 year, 1 to 5 years, 6 to

10 years, 11 to 15 years, 16 to 20 years, 21 to 25 years, 26 to 30 years, and more than 30

years (MSDE, 2010). (Teachers who transferred from one Maryland school district to

another are not included in these analyses, as they are still considered to be retained.)

When taking the midpoints of these ranges and weighting them by the distribution of

teachers (total N=3,797) in each category who left teaching during or after the 2009-2010

school year as reported by MSDE (2010), I calculated an average attrition point of 11

years of teaching experience. (For the lowest category, the range was 0 to 1 year with a

set midpoint at 0.5 years, while for the uppermost category, I projected the range to be 31

to 35 years with a set midpoint at 33 years.)

In Table 4, the baseline year for the salary calculations was 2008-2009 (assuming

that the student began his or her associate's degree studies in 2004-2005 and graduated

with a bachelor's degree in 2007-2008). Using the teaching salary projections that were

presented in Table 3, but ending the projections at year 11 to approximate expected

longevity in teaching, the starting annual salary figure was $42,537 in 2008-2009, and

was projected to end an annual salary of $62,965 in 2018-2019, assuming an annual

salary increase of 4%. In discounted terms, applying a rate of 4%, the calculations

yielded $467,907 in expected returns to teaching over an initial 11-year span of

employment. However, the future benefits stream did not stop in its entirety in year 11,

as alternate earnings were still assumed to accrue to the individual, even though these

earnings were not considered as returns to teaching for the purposes of this study.

Consistent with Table 3, the entire benefits stream for this variation of the optimal

completer was projected to accrue over a period of 33 years. As a result, it was necessary

to calculate alternate returns for years 12 to 33 of the benefits stream, where the teaching

earnings dropped off, with a baseline year of 2019-2020 for the remainder of the salary

calculations (i.e, non-teaching returns).

The baseline salary figure for non-teaching returns in this study was derived from

a series of calculations, beginning with the reported average annual starting salary for

2008 bachelor's degree recipients in the United States, which was $49,224 for all career

and degree fields combined, according to the National Association for Colleges and

Employers (NACE) (2008) annual *Salary Survey*. Assuming an annual salary increase of

4%, this figure was projected forward with 2019-2020 as the baseline earnings year (i.e.,

the point at which teaching earnings would be expected to drop off). Ultimately, these

calculations yielded a 22-year benefits stream beginning with an annual salary of $75,778

in 2019-2020 and ending with an annual salary of $172,681 in 2040-2041. When

applying a discount rate of 4% to all future earnings, the 22-year total income stream

went from $2,595,246 (undiscounted) to $1,082,928 (discounted). When combined with

the projected discounted earnings from teaching in years 1 to 11 ($467,907), the total

discounted benefits stream for this variation of the optimal completer was $1,550,835.

Taking the difference between the discounted income stream for bachelor's degree

recipients under this scenario and the discounted income stream for high school graduates

($558,360) that was previously calculated, the discounted earnings premium for expected

returns to teaching was calculated as $992,475 in Table 4, including $299,443 as the

discounted earnings premium associated with future teaching income in years 1 to 11,

and $693,032 as the discounted earnings premium associated with future alternate income

in years 12 to 33.

In calculating the revenue stream from taxes on the future income earnings premium presented in Table 4, an aggregate rate of 7.57% was applied, which included the state's income tax rate of 4.75% in 2008 (assuming a taxable net income range of $3,000 to $150,000) and a statewide average local income tax rate of 2.82% (Comptroller of Maryland, 2008). As shown in Table 4, the total revenue from state taxes that could be expected from the $992,475 future benefits stream was $75,130. However, since some degree of outmigration from the state could be expected over the course of the optimal completer's career, this calculated amount would likely overestimate potential returns to Maryland taxpayers. Unlike the maximum benefit returns calculated in Table 3, in which the optimal completer spent his or her entire career teaching in Maryland, the variation of the optimal completer presented in Table 4 was assumed to follow a more typical pathway of post-graduate employment (based on actual data trends associated with college recent graduates in Maryland).

In order to provide a more accurate representation of the potential tax benefits associated with this variation of the optimal completer, two sets of data adjustments were considered. The first was the rate at which the graduate was likely to begin working in Maryland upon receiving a bachelor's degree from a Maryland four-year institution. The second was the rate at which the student was likely to move away from Maryland over time, and therefore no longer pay Maryland state income taxes. The first projections were taken from MHEC's one-year follow-up survey of 2007 graduates of Maryland four-year institutions, and reflect the percentage of bachelor's degree recipients who were employed in Maryland a year after graduation. (Note: 2007 is the most recent year for which such data are available). The figure (75%) for students who were originally

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Maryland residents was used, as opposed to the figure (25%) for students who were originally from out-of-state, since the vast majority of students who begin their education at a community college are in-state residents (MHEC, 2009b). The second projections were based on net outmigration statistics reported by the Maryland Governor's Workforce Investment Board (GWIB). In 2008, the annual net outmigration rate for Maryland was .4% (GWIB, 2008). When weighting total tax revenues by the likelihood of a student immediately working in Maryland upon graduation (75%) and the net effects of outmigration (.4% in years 2 through 33 of the discounted tax benefits stream), the total in tax revenue stream was reduced from $75,130 to $52,894 in Table 4.

Table 5 presents the variation in which the hypothetical optimal completer finished each portion of the two-year to four-year teacher education pipeline and graduated, but did not go into teaching at any point in his or her career. Thus, the benefits stream in Table 5 considered earnings from alternate employment routes outside of teaching in a Maryland public school. Consistent with the approach in Tables 3 and 4, benefits were calculated over a 33-year period. The baseline year for these salary calculations was 2008-2009 (assuming that the student began his or her associate's degree studies in 2004-2005 and graduated with a bachelor's degree in 2007-2008). The baseline salary figure was derived from a series of calculations, using the same sources and methodology described in Table 4 for the alternate benefits stream in years 12 through 33. In this case, however, the baseline year was set at 2008-2009, and the benefits stream of alternate earnings spanned the entire 33 years of projected employment. Ultimately, these calculations yielded a 33-year benefits stream beginning at $49,224 in 2008-2009 and ending at $172,681 in 2040-2041, assuming an annual

salary increase of 4%. When applying a discount rate of 4% to all future earnings, the

33-year total income stream went from $3,259,098 (undiscounted) to $1,624,392

(discounted). Taking the difference between the discounted income stream for bachelor's

degree recipients under this scenario and the discounted income stream for high school

graduates ($558,360) that was previously calculated, the total earnings premium for

alternate returns to teaching was calculated as $1,066,032 in Table 5.

In calculating the revenue stream from taxes on the future income earnings

premium presented in Table 5, an aggregate rate of 7.57% was applied, which included

the state's income tax rate of 4.75% in 2008 (assuming a taxable net income range of

$3,000 to $150,000) and a statewide average local income tax rate of 2.82% (Comptroller

of Maryland, 2008). Applying this rate, the total revenue from state taxes that could be

expected from the $1,066,032 future benefits stream was $80,699. Adjustments were

then made to account for the likelihood of working in Maryland and the effects of

outmigration over time, consistent with the assumptions explained above for Table 4.

When weighting the total tax revenues by the likelihood of a student immediately

working in Maryland upon graduation (75%) and the net effects of outmigration (.4% in

years 2 through 33 of the discounted tax benefits stream), the total tax revenues were

reduced from $80,699 to $56,796.

Finally, Table 6 represents the case in which the hypothetical optimal completer

student completed each portion of the two-year to four-year teacher education pipeline

but left the State of Maryland for post-graduate employment (and was not assumed to

return to the state as a worker at any point in his or her career). While there were no

benefits that accrued to Maryland taxpayers from this case, there were still benefits that

accrued to the individual in the form of a future income stream. For this case variation in Table 6, the future income stream was projected as the alternate earnings benefits premium (assuming that this variation of the optimal completer could be teaching or employed in an alternate career field outside of Maryland), consistent with the calculations in Table 5 that projected a 33-year discounted benefits premium of $1,066,032, with the average starting salary for bachelor's degree recipients in 2008 as the baseline. No returns to society (i.e., state tax revenues) were calculated for this final variation of the optimal completer case, however, since this hypothetical student was assumed to reside and work outside of Maryland for his or her entire career.

Calculation of Costs for the Optimal Completer Case

Unlike the benefits premium calculations in the previous section, which assumed four potential sets of employment outcomes (maximum returns to teaching, expected returns to teaching, alternate returns to teaching, and no returns to teaching), the calculations related to educational costs were consistent across Tables 3 through 6, since the optimal completer case assumed maximum efficiency in the two-year to four-year teacher education transfer pipeline. As explained in Chapter 3, the following categories of educational costs were considered in this benefit-cost analysis: tuition and fees, books and supplies, state subsidy, financial aid, foregone earnings, and foregone taxes. Again, this hypothetical student was assumed to enroll in an AAT or AA transfer program in a Maryland community college, complete the associate's degree in two years, immediately transfer to a four-year public or independent institution in Maryland, enter an education major, and complete the bachelor's degree in two years. (Additional variations on the

teacher preparation transfer pipeline are considered in the "typical completer" and "non-completer" case sections later in this chapter.)

Tuition and Fees

The tuition and fee calculations assumed two years of full-time enrollment in a Maryland community college (FY05 and FY06) and two years of full-time enrollment in a Maryland four-year institution (FY07 and FY08). Statewide average tuition rates for full-time students, weighted by institutional enrollment and including only those institutions with undergraduate teacher preparation programs, were used for each sector (MHEC, 2006a, 2007a, 2008b, 2009a). Using these assumptions, the baseline tuition and fee figures for FY05 were $2,880 for students enrolled in Maryland community colleges, $6,444 for students enrolled in Maryland four-year public institutions, and $21,148 for students enrolled in Maryland four-year independent institutions (MHEC, 2006a). For the purposes of this study, data for the latter two years of enrollment were weighted by the likelihood of a Maryland community college student transferring to a four-year public institution (86%) versus a four-year independent institution (14%) (MHEC, 2004a)—resulting in a blended four-year tuition rate for the latter two years of college enrollment. In-state tuition rates were used for public institutions since the majority of Maryland community college students were assumed to be Maryland residents (93% in fall 2004), or would be eligible to establish in-state residency before their final two years of college enrollment at a four-year public institution (MACC, 2005).

Using the assumptions described above, the tuition and fee calculations for the optimal completer case in this study were $2,880 for FY05 (first year of full-time enrollment in a community college), $3,030 for FY06 (second year of full-time

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enrollment in a community college), $9,252 for FY07 (third year of full-time enrollment

in a public or independent four-year institution, using a blended tuition rate), and $9,581

for FY08 (fourth year of full-time enrollment in a public or independent four-year

institution, using a blended tuition rate)—for a total of $24,743 in tuition and fees for

four years of full-time college enrollment. Again, these calculations were based on the

actual tuition and fee figures that were reported for each Maryland higher education

sector in FY05 through FY08.

Books and Supplies

Using national averages reported by the College Board (2004) for FY05, the

baseline figures for college books and supplies were estimated at $745 for full-time

students enrolled in community colleges and $817 for full-time students enrolled in

public or independent four-year institutions. The adjusted calculations for books and

supplies in the current benefit-cost model assumed that students would spend their first

two years of enrollment at a Maryland community college (FY05 and FY06) and their

third and fourth years of enrollment at a Maryland four-year institution (FY07 and

FY08). An inflationary factor of 4% (the October 2005 inflation rate per the Consumer

Price Index) was applied to the baseline figures in order to arrive at cost estimates for

subsequent years of full-time enrollment.

These calculations assumed that Maryland students in the optimal completer

pipeline would spend $745 on books and supplies during their first year of enrollment

(assuming the FY05 College Board national average of $745 as the community college

baseline), $775 during their second year (assuming the FY05 College Board national

average of $745 as the community college baseline, and applying one annual increase of

4%), $884 during their third year (assuming the FY05 College Board national average of $817 as the four-year institution baseline, and applying two annual increases of 4% each), and $919 during their fourth year (assuming the FY05 College Board national average of $817 as the four-year institution baseline, and applying three annual increases of 4% each)—totaling $3,323 in books and supplies expenses over four years of college enrollment.

State Subsidy

The state subsidy calculations for the optimal completer case assumed two years of full-time enrollment in a Maryland community college (in FY05 and FY06) and two years of full-time enrollment in a Maryland public or independent four-year institution (in FY07 and FY08). In Maryland, state subsidies for higher education are structured as annual state monies from the General Fund that are allocated directly to eligible Maryland higher education institutions based on full-time equivalent (FTE) student enrollment. In this study, the community college subsidy was based on the state's Cade funding program per FTE student enrolled in Maryland public community colleges—which was $2,086 per FTE in FY05 and $2,193 per FTE in FY06 (MACC, 2006, 2007). For Maryland four-year public institutions, this subsidy was $8,823 per FTE in FY07 and $9,290 per FTE in FY08. For Maryland four-year independent institutions that were eligible for state aid through the Sellinger funding program, the comparable state subsidy was $1,248 per FTE in FY07 and $1,393 per FTE in FY08 (MHEC, 2008b, 2009a). Calculations for FY07 and FY08 were then weighted by the likelihood of a Maryland community college student transferring to a four-year public institution (86%) versus a four-year independent institution (14%) (MHEC, 2004a). Using these data, the total state

subsidy for four years of full-time student enrollment in this study (FY05 and FY06 at a Maryland community college and FY07 and FY08 at either a Maryland four-year public or independent institution) was $20,226, which was calculated as follows: $2,086 + $2,193 + (($8,823 x .86) + ($1,248 x .14)) + (($9,290 x .86) + ($1,393 x .14)).

In these calculations, I assumed that Maryland taxpayers would carry the full costs that were associated with the state subsidy to higher education institutions. While cost reductions from the state subsidy would potentially benefit students (by offsetting tuition and fee rates, for example), these subsidies, per state regulations, are paid directly to Maryland higher education institutions, not to individual students. Therefore, the state subsidy was not considered to be an internal transfer payment in this benefit-cost model. (In contrast, financial aid costs were considered to be an internal transfer payment between taxpayers and students in this benefit-cost model, and adjustments were made to account for the estimated portion of financial aid that was projected to originate from Maryland state subsidy sources. The associated assumptions and calculations for these adjustments will be discussed in further detail in the section below.)

Financial Aid

The financial aid data in this study were drawn from reports generated from MHEC's Financial Aid Information System (FAIS) and were based on the average financial aid package per undergraduate student recipient in Maryland two-year and four-year public and independent institutions (MHEC, 2006b, 2007c, 2008c, 2009c). These financial aid figures included grants, scholarships, and work study awards from federal, state, institutional, and private sources. (Loans were excluded from these analyses since students must repay them in the future.) The baseline numbers for FY05 were $1,936 per

student recipient enrolled in Maryland community colleges (taking the average financial

aid award of $2,689 per undergraduate recipient and applying a reduction of 28% to

account for the proportional distribution of student loans in the total award figure),

$3,964 per student recipient enrolled in Maryland four-year public institutions (taking the

average financial aid award of $9,219 per undergraduate recipient and applying a

reduction of 57% to account for the proportional distribution of student loans in the total

award figure), and $8,668 per student recipient enrolled in Maryland four-year

independent institutions (taking the average financial aid award of $15,478 per

undergraduate recipient and applying a reduction of 44% to account for the proportional

distribution of student loans in the total award figure) (MHEC, 2006b). For the purposes

of this study, these figures were also weighted by the likelihood of a student in the

pipeline actually being a financial aid recipient (using FY05 figures as the baseline)—

45% of all Maryland community college students, 65% of all Maryland four-year public

institution students, and 89% of all Maryland four-year independent institution students

(MHEC, 2007b).

Consistent with the pipeline analysis in this study, the calculations for the optimal

completer case assumed the first two years of enrollment at a Maryland community

college (drawing on FY05 and FY06 FAIS financial aid data) and the second two years

of enrollment at a Maryland four-year institution (drawing on FY07 and FY08 FAIS

financial aid data). Data for the latter two years were weighted by the likelihood of a

Maryland community college student transferring to a four-year public institution (86%)

versus a four-year independent (14%) (MHEC, 2004a). The total amount of financial aid

was estimated at $8,867 over four years of college enrollment, assuming the following weighted calculations:

FY05 ($1,936 x .45) = $871.

Where $1,936 was the average FY05 financial aid award (adjusted to exclude loans) for community college student recipients, and the likelihood of being an aid recipient was 45%.

FY06 ($2,008 x .45) = $904.

Where $2,008 was the average FY06 financial aid award (adjusted to exclude loans) for community college student recipients, and the likelihood of being an aid recipient was 45%.

FY07 (($4,137 x .65)) x .86) + (($9,464 x .89)) x .14) = $3,492.

Where $4,137 was the average FY07 financial aid award (adjusted to exclude loans) for four-year public institution student recipients, and the likelihood of being an aid recipient was 65%, where $9,464 was the average FY07 financial aid award (adjusted to exclude loans) for four-year independent institution student recipients, and the likelihood of being an aid recipient was 89%, and where 86% of students in the pipeline were assumed to have transferred to a public institution versus 14% to an independent institution.

FY08 (($4,237 x .65)) x .86) + (($9,890 x .89)) x .14) = $3,600.

Where $4,237 was the average FY08 financial aid award (adjusted to exclude loans) for four-year public institution student recipients, and the likelihood of being an aid recipient was 65%, where $9,890 was the average FY08 financial aid award (adjusted to exclude loans) for four-year independent institution

student recipients, and the likelihood of being an aid recipient was 89%, and

where 86% of students in the pipeline were assumed to have transferred to a

public institution versus 14% to an independent institution.

Since Maryland is a state that provides funding directly to colleges and

universities (see the state subsidies discussion above), including aid-eligible four-year

independent institutions, I also considered the possibility that some portion of the state

subsidy may have been passed on to students directly in the form of financial aid, namely

institutional grants and institutional scholarships. In the context of this benefit-cost

analysis, including both the full costs of the state subsidy (calculated in the previous

section) and the full costs of financial aid (calculated in this section) may actually double-

count a portion of the total costs for taxpayers. Therefore, I reduced the average financial

aid award of $8,867 by a factor of 21% (to $7,005, a reduction of $1,862) to approximate

the amount of financial aid that may have been derived from state subsidy sources and

passed on directly to students in the aid categories of institutional grants and institutional

scholarships. The estimate of 21% was derived from FAIS figures as a breakdown of the

distributional proportion of institutional grant sources and institutional scholarship

sources for undergraduate financial aid recipients statewide in Maryland in FY05

(MHEC, 2006b). Since financial aid was considered to be an "internal transfer" between

taxpayers and students in this benefit-cost analysis (i.e., financial aid was a cost to

taxpayers that offset some portion of the costs to students), the net cost to society was

calculated as -$1,862 (-$8,867 for students and $7,005 for taxpayers), as this was the

projected amount of financial aid that was already accounted for in the previous state

subsidy calculations.

Foregone Earnings and Taxes

Foregone earnings were calculated using the 2004 median weekly earnings of full-time wage and salary workers ages 25 years and over, by level of educational attainment and gender, from the *Current Population Survey* (Bureau of the Census, 2004a). In terms of level of educational attainment, students in the pipeline in this study were assumed to be high school graduates who had not attained a college degree. For males in the United States in 2004, the annualized median salary at this level of educational attainment was $33,540; for females, it was $25,376 (Bureau of the Census, 2004a). For the purposes of this analysis, additional adjustments were made since these salary figures were based on individuals who were ages 25 and over in the workforce, whereas the community college student population would be expected to include recent high school graduates as well. Using previous assumptions employed by Christophersen and Robison (2003) in their study of the economic impact of Maryland community colleges, half of the student pipeline in this study was assumed to be ages 25 years and older, while the other half was assumed to be under the age of 25. Weights were then applied to these salary figures based on *Current Population Survey* earnings patterns for workers ages 16 to 24 in 2004, assuming that half of the males would earn only 52% of the ages 25 and over full salary figure of $33,540, and half of the females would earn only 63% of the ages 25 and over full salary figure of $25,376 (Bureau of the Census, 2004c). This led to the calculation of salaries of $17,440 for males under the age of 25 in the educational pipeline and $15,987 for females under the age of 25 in the educational pipeline.

Two additional assumptions were factored into these foregone earnings

calculations. First, based on the demographics of professional teaching staff in Maryland

public schools (MSDE, 2008a), 23% of the community college students in this pipeline

were predicted to be male and 77% were predicted to be female. Second, students in this

pipeline were assumed to follow general national trends of workforce employment and

unemployment, so prevailing national rates for 2004-2005 were applied (94.5%

employed and 5.5% unemployed) (Bureau of Labor Statistics, 2005). Taking into

account the projected distribution of male and female earners ages 25 and over (the first

set of salary figures in each row below), the projected distribution of male and female

earners under the age of 25 (the second set of salary figures in each row below), and the

expected employment rate of 94.5%, the foregone earnings calculations were as follows:

For males: (($33,540 x .50) + ($17,440 x .50)) x .945 = $24,088.

For females: (($25,376 x .50) + ($15,987 x .50)) x .945 = $19,544.

In further weighting these salary figures to reflect the anticipated distribution of

students in the pipeline by gender (.23 for males and .77 for females), the blended salary

figure was calculated as: ($24,088 x .23) + ($19,544 x .77) = $20,589. In applying a 4%

annual earnings increase on this base salary over three subsequent years of college

enrollment, the total foregone earnings stream totaled $87,431 ($20,589 for Year 1 +

$21,413 for Year 2 + $22,269 for Year 3 + $23,160 for Year 4).

The use of salary data for fully employed individuals would likely overestimate

the total costs of foregone earnings in this study since many students still work, either

part-time or full-time, while they are enrolled in college. Thus, undergraduate student

employment data from NCES were considered to determine the extent to which the full

amount of foregone earnings should be reduced to account for student employment (Aud, et al., 2011). Using NCES data, the four-year figure that was previously calculated for foregone earnings ($87,431) was adjusted downward to account for the likelihood of a student working while attending either a two-year or four-year institution, as well as the average number of hours worked per week.

Since the point of entry into the optimal completer pipeline in the study was positioned during the 2004-2005 academic year, and the optimal completer was assumed to be a full-time student, I drew upon national student employment data for full-time undergraduate students in 2005, as reported by NCES (Aud, et al., 2011). According to these figures, 52% of full-time undergraduate students were not employed, 18% were employed and working less than 20 hours per week, 21% were employed and working 20 to 34 hours per week, and 9% were employed and working 35 hours or more per week. These data include community college students as well as students enrolled in four-year public and independent institutions. Since students in the optimal completer pipeline in the current study were assumed to attend both a two-year institution and a four-year institution (either public or independent) over the course of their four years of college enrollment, aggregated earnings percentages for full-time undergraduates across all higher education sectors were applied in the analysis.

Applying weights that were derived from the NCES data (Aud, et al., 2011) to the previously calculated total four-year foregone earnings figure of $87,431, I assumed there was a 52% probability that the optimal completer was earning nothing to offset the total foregone earnings; an 18% probability that the optimal completer was earning 25% of the foregone earnings (working 0 to 20 hours per week, assuming a range midpoint of 10

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hours, or 25% of a 40-hour work week); a 21% probability that the optimal completer was earning 68% of the foregone earnings (working 20 to 34 hours per week, assuming a range midpoint of 27 hours, or 68% of a 40-hour work week); and a 9% probability that the optimal completer was earning 100% of the foregone earnings (working 35 or more hours per week). These calculations yielded a total of $24,288 in undergraduate student earnings concurrent with enrollment, or ((0 x .52) + ($87,431 x .18 x .25) + ($87,431 x .21 x .68) + ($87,431 x .09 x 1.00)). When subtracting the $24,288 in student earnings from the four-year foregone earnings stream, the total was reduced from $87,431 to $63,143. Consistent with the previous methods used for calculating taxes on income (see "Calculation of Benefits for the Optimal Completer Case" section), a blended Maryland state tax rate of 7.57% was applied to the adjusted foregone earnings stream of $63,143, totaling $4,780 in foregone tax revenues for the state.

Net Present Value for the Optimal Completer Case

The first research question in this study addressed the benefits and costs that were associated with optimizing the transfer student pipeline in teacher preparation between Maryland community colleges and Maryland four-year institutions. The hypothetical "optimal completer" enrolled in an AAT or AA transfer program in a Maryland community college, completed the associate's degree in two years, immediately transferred to a four-year public or independent institution in Maryland, entered an education major, completed the bachelor's degree in two years, immediately took a teaching job in Maryland, and spent his or her entire career teaching in Maryland. Using 2004-2005 as the baseline year, the net present value that was calculated for this case was $795,002 (presented in Table 3).

Three variations of the optimal completer case were also considered in order to account for a broader range of post-graduate employment outcomes among community college students in the teacher preparation transfer pipeline. While the calculated costs for each of these case variations were the same as those presented in Table 3 (i.e., since students were equally assumed to have optimized the higher education portion of the pipeline), the discounted benefits streams were adjusted to reflect alternate paths of post-graduate employment: expected returns (assuming that some graduates would spend a portion of their career in the teaching profession in Maryland, but not their entire career); alternate returns (assuming that some graduates in the pipeline would not enter teaching, but choose to hold employment in another career field in Maryland for a specified period of time); and no returns (assuming that some graduates in the pipeline would leave Maryland altogether to pursue post-graduate employment, either in teaching or in an alternate career field). The calculated net present values were $931,016 for expected returns (presented in Table 4), $1,008,475 for alternate returns (presented in Table 5), and $951,679 for no returns (presented in Table 6).

It is worth noting here that the lowest calculated net present value for the optimal completer case was for the variation of completer with the post-graduate outcome of career service as a Maryland teacher, which can be attributed to a lower average starting salary as compared with bachelor's degree recipients in other career fields. Graduates who spent a more limited amount of time in teaching, or who pursued employment in an alternate (non-teaching) career field altogether, had higher projected net present values. When examining this finding in a broader economic framework of supply-demand and incentives structures, it may have important negative consequences for the state in terms

of its ability to produce and hire sufficient numbers of qualified K-12 teachers from its

colleges and universities. This issue will be examined further in Research Question 4

(when the net present value data are analyzed in the context of three alternative teacher

preparation scenarios) as well as in the broader discussion of the study's findings and

conclusions in Chapter 5.

<center>**Research Question 2: Typical Completer Case**</center>

The second research question in this study considers the economic benefits and

costs that are associated with the typical transfer student pipeline in teacher preparation

between Maryland community colleges and Maryland four-year institutions. Using the

benefit-cost framework from Table 2 in the previous chapter, Tables 7, 8, 9, and 10

document the economic benefits and costs for one representative "typical completer" in

the study. Similar to the optimal completer case, this hypothetical community college

student initially enters the AA or AAT pipeline at the community college, transfers, and

graduates with a bachelor's degree in education from a four-year institution. Since

typical completer students in this study are bachelor's degree recipients, the range of

expected returns (benefits) under consideration are identical to those presented for the

optimal completer (i.e., calculations of maximum returns to teaching, expected returns to

teaching, alternative returns to teaching, and no returns to teaching). However, the cost

calculations for the typical case are adjusted to reflect the average rate at which Maryland

community college students typically progress through and complete this two-year to

four-year higher education pipeline, as well as the point at which they typically transfer.

Four variations on the typical completer case are presented in Tables 7 through 10 below,

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followed by an explanation of the benefit and cost calculations and supporting data

sources for each table.

Table 7

Benefits/Costs for the Typical Completer Case: Maximum Returns to Teaching

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income	845,361		845,361
Future Alternate Income			
Future Taxes		63,994	63,994
Total Benefits	845,361	63,994	909,355
Educational Costs			
Tuition and Fees	30,721		30,721
Books and Supplies	3,621		3,621
State Subsidy		24,781	24,781
Financial Aid	-10,920	8,627	-2,293
Foregone Earnings	74,085		74,085
Foregone Taxes		5,608	5,608
Total Costs	97,507	39,016	136,523
Net Present Value	747,854	24,978	772,832

Table 8

Benefits/Costs for the Typical Completer Case: Expected Returns to Teaching

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income	299,443		299,443
Future Alternate Income	693,032		693,032
Future Taxes		52,894	52,894
Total Benefits	992,475	52,894	1,045,369
Educational Costs			
Tuition and Fees	30,721		30,721
Books and Supplies	3,621		3,621
State Subsidy		24,781	24,781
Financial Aid	-10,920	8,627	-2,293
Foregone Earnings	74,085		74,085
Foregone Taxes		5,608	5,608
Total Costs	97,507	39,016	136,523
Net Present Value	894,968	13,878	908,846

Table 9

Benefits/Costs for the Typical Completer Case: Alternate Returns to Teaching

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income			
Future Alternate Income	1,066,032		1,066,032
Future Taxes		56,796	56,796
Total Benefits	1,066,032	56,796	1,122,828
Educational Costs			
Tuition and Fees	30,721		30,721
Books and Supplies	3,621		3,621
State Subsidy		24,781	24,781
Financial Aid	-10,920	8,627	-2,293
Foregone Earnings	74,085		74,085
Foregone Taxes		5,608	5,608
Total Costs	97,507	39,016	136,523
Net Present Value	968,525	17,780	986,305

Table 10

Benefits/Costs for the Typical Completer Case: No Returns to Teaching

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income			
Future Alternate Income	1,066,032		1,066,032
Future Taxes			
Total Benefits	1,066,032		1,066,032
Educational Costs			
Tuition and Fees	30,721		30,721
Books and Supplies	3,621		3,621
State Subsidy		24,781	24,781
Financial Aid	-10,920	8,627	-2,293
Foregone Earnings	74,085		74,085
Foregone Taxes		5,608	5,608
Total Costs	97,507	39,016	136,523
Net Present Value	968,525	-39,016	929,509

Calculation of Benefits for the Typical Completer Case

In Tables 7 through 10, four variations of the typical completer case were presented in order to account for a range of post-graduate outcomes (and corresponding benefits streams) among community college students in the two-year to four-year teacher education pipeline. As was the case for the optimal completer, the typical completer entered higher education through a Maryland community college and exited as a bachelor's degree recipient from a Maryland four-year college or university. Although the typical completer's rate of progression through the higher education pipeline was assumed to be slower than that of an optimal completer, there were no data to suggest that the typical completer's post-graduate earnings profile would necessarily differ from that of an optimal completer. While the timeframe for the point of entry into the workforce would be slightly delayed for the typical completer, who spent more time, on average, in the higher education pipeline than the optimal completer, the benefits stream of 33 years of discounted earnings was still assumed as the average worklife expectancy, consistent with the Gamboa Gibson Worklife Table data (Sidlow & Vega, 2010).

For the purposes of this study, then, the earnings premium that was associated with the typical completer's bachelor's degree was assumed to parallel the earnings premium of the optimal completer's bachelor's degree. The earnings premium was calculated to reflect the true value of the educational benefit under consideration, which, in this case, was the difference between future income that was projected to accrue from earning a bachelor's degree versus earning a high school degree. Thus, the earnings premium benefits streams (and projected tax revenues) for each variation of the typical completer case in Tables 7 through 10 were identical to those of each variation of the

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optimal completer case presented in Tables 3 through 6 earlier in this chapter. The totals

for the typical completer case were $845,361 in future discounted earnings and $63,994

in future discounted taxes for maximum returns to teaching; $992,475 in future

discounted earnings and $52,894 in future discounted taxes for expected returns to

teaching; $1,066,032 in future discounted earnings and $56,796 in future discounted

taxes for alternate returns to teaching; and $1,066,032 in future discounted earnings and

$0 in future discounted taxes for no returns to teaching. The data sources, assumptions,

and calculations for these benefits were presented earlier in this chapter in the

"Calculation of Benefits for the Optimal Completer Case" section.

Calculation of Costs for the Typical Completer Case

Using the baseline educational costs (tuition and fees, books and supplies, state

subsidy, financial aid, and foregone earnings and taxes) that were calculated for the

optimal completer case in Tables 3 through 6, several adjustments were made for the

typical completer case. As was the case for the optimal completer, the typical completer

was assumed to have entered higher education through a Maryland community college

and later exited from a Maryland four-year institution as a bachelor's degree recipient.

However, the typical completer was projected to follow the rate at which Maryland

community college students typically progress through and complete this two-year to

four-year higher education pipeline, as well as the point at which community college

students typically transfer. Taking these factors into account, the education-related costs

for the typical completer were presented in Tables 7 through 10; the costs were held

equal in each table since the typical completer was assumed to be one representative

community college student who followed this path through degree completion. (In

contrast, the future benefits varied in each of the four tables in order to capture a range of post-graduate employment outcomes for the typical completer, with respect to teaching and alternate career fields.)

The first set of adjustments for the typical completer case addressed the point at which Maryland community college students typically transfer from a two-year institution to a four-year institution. The optimal completer scenario, which was designed to represent maximum efficiency in the two-year to four-year transfer pipeline, assumed that the student would transfer at the beginning of his or her junior year, after two years of full-time enrollment at a Maryland community college and upon receipt of an associate's degree. In reality, however, the majority of Maryland community college students attend school part-time (MHEC 2005a), and among those who eventually transfer to a four-year institution, the majority do so prior to attaining an associate's degree (USM, 2009). For example, among Maryland community college students who sent their transcripts to a four-year institution within USM in 2009, with the stated intention of transferring, only 23% had attained an associate's degree (USM, 2009). Among the subset of community college students enrolled in teacher preparation programs (AA or AAT), this attainment statistic was only 20% (USM, 2009). (At the same time, one could reasonably assume that these figures would represent lower end estimates of associate's degree attainment, since community college students may still be in the process of degree completion at the time of their transfer application.)

Similar trends can be observed when analyzing class standing data at the time of transfer. Among Maryland community college students who transferred to a four-year public USM institution in FY04, for example, 881 (17%) did so as freshmen, 2,062

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(40%) as sophomores, 1,993 (39%) as juniors, and 218 (4%) as seniors (USM, 2010).

Data through FY09 indicated that the class standing distribution of Maryland community

college transfer students has been relatively constant over time (USM, 2010). While no

statewide "typical point of transfer" statistic is currently available, and the data structure

of Maryland's Transfer Student System does not provide a definitive calculation for

community college students entering four-year institutions with an associate's degree in

hand, for the purposes of this study, it was reasonable to conclude that the majority of

Maryland community college students who transfer do so prior to attaining junior-level

status. As a result, community college students would, on average, be expected to

accumulate more credits from a four-year institution than from a two-year institution,

provided they persist through completion of a bachelor's degree.

In order to arrive at a "typical point of transfer" statistic for the purposes of this

study, I analyzed the class standing distribution data among Maryland community college

transfers to USM four-year public institutions, assuming that a bachelor's degree was a

standard 120 credits with the following definitions for transfer student class standing:

12-29 credits for freshmen, 30-59 credits for sophomores, 60-89 credits for juniors, and

90-120 credits for seniors. (The lower limit of 12 credits rather than 0 credits was chosen

for freshman class standing, since students have to attain a minimum of 12 credits prior to

transfer in order to be considered as transfer students in Maryland, versus first-time

freshmen.) Based on the reported distribution of Maryland community college students

in each of these class standing categories at the time of transfer in FY04 (see USM,

2010), I set the average student credit count at the mid-point range for the freshman and

sophomore categories (20.5 credits and 44.5 credits, respectively), and the credit count at

60 for juniors (assuming that the majority of students in this category would be associate's degree recipients without additional coursework to transfer). In this study, a common minimum standard of 60 credits was used for the associate's degree and 120 credits for the bachelor's degree, although degree lengths may vary according to the student's institution of enrollment and area of specialization (typically 60 to 66 credits at the associate's degree level for the AA or AAT, and 120 to 129 credits at the bachelor's degree level in education). I did not include transferring seniors in this particular set of calculations, assuming that their high credit count could be attributed to factors outside of community college enrollment (including attendance at multiple institutions), and given the residency requirements for the bachelor's degree at most four-year institutions, these students would most likely exceed the standard 120-129 credit count range for the bachelor's degree. (However, transfer students with senior class standing were considered in later calculations for redundant coursework, as discussed below.)

Using these assumptions and the FY04 class standing distribution data for Maryland community college transfer students (USM, 2010), I calculated a per-student average credit load of 46 credits at the time of transfer, or approximately 38% of a bachelor's degree consisting of 120 credits: ((20.5 credits x .18 [adjusted proportion of freshman transfer students, minus seniors]) + (44.5 credits x .42 [adjusted proportion of sophomore transfer students, minus seniors]) + (60 credits x .40 [adjusted proportion of junior transfer students, minus seniors])). Since these calculations included freshmen, sophomores, and juniors, this aggregated "typical point of transfer" statistic represented both Maryland community college students who had transferred prior to attaining an associate's degree, and those who had transferred upon attaining an associate's degree.

Thus, for the purposes of this study, I assumed that 38% of the typical completer's credits (N=46 credits) would be taken at a community college (at a lower average per-credit cost), and 62% of the typical completer's credits (N=74 credits) would be taken at a four-year institution (at a higher average per-credit cost).

The second set of adjustments for the typical completer case considered the potential for loss of credit during the two-year to four-year transfer process, which would increase costs both for the individual student and for Maryland taxpayers. Loss of credit can occur when students take community college courses that do not fulfill four-year degree requirements at the transfer institution, that do not serve as appropriate prerequisites for upper-level courses at the transfer institution, or that end up being outside of the student's chosen major field for the bachelor's degree. There is substantial diversity across the 50 states in their approach to the regulation of transfer and articulation policies and practices, making the likelihood of transfer credit loss a real possibility for students, particularly when transferring to or from a for-profit institution or an out-of-state institution. (See Ewell, Boeke, & Zis (2008) for a comprehensive inventory of state policies on higher education transfer and articulation.) At the same time, however, since the underlying assumptions associated with the typical completer case in this study were that this student would be transferring between Maryland institutions within the same field of study, and since transfer and articulation regulations are codified in Maryland (under COMAR), I assumed that the possibility of loss of credit would be minimal for the typical completer. Similar to the "typical point of transfer" discussion above, "typical loss of transfer credit" was another area in which no statewide

statistics for Maryland were available, so my projections and assumptions for these calculations were made from related data sources.

In order to account for the potential for loss of academic credit during the transfer process, I again consulted USM's (2010) class standing data for community college transfer students, and assumed that those students transferring as freshmen (17%) and seniors (4%) would be at the greatest risk for redundant coursework. I assumed that freshman transfers would fall into this risk category since they would be the least likely of all students to transfer with their lower-division general education requirements complete (versus sophomores and juniors), and that they would have the lowest level of commitment to an academic major or definitive course of study. Likewise, I assumed that senior transfers would fall into this risk category since most institutions have residency requirements for completing the final portions of the academic major and bachelor's degree. In comparison, I predicted that sophomores and juniors would be at a lower risk for losing transfer credit, since they should be closer to the completion of the required general education block or even an entire associate's degree, which would be more likely to articulate with bachelor's degree requirements at a four-year institution. In the absence of other available data, I projected that transferring freshmen would, on average, lose the equivalent of two courses (6 credits). I also projected that transferring seniors would be at the range mid-point of 105 credits earned (assuming that senior standing was 90 to 120 credits). Seniors were projected to lose 35 credits in transfer, on average, which was the number of earned credits above and beyond the Maryland four-year institution transfer limit of 70 credits from a Maryland community college, as specified in COMAR.

When taking the USM (2010) transfer student class standing data and spreading

the risk of transfer credit loss among the freshmen and seniors to the remaining 79% of

the students who transferred as either sophomores or juniors, the calculated average loss

was 3 academic credits per transfer student ((6 lost credits x 881 freshmen, or 17%) + (0

lost credits x 2,062 sophomores, or 40%) + (0 lost credits x 1,993 juniors, or 39%) + (35

lost credits x 218 seniors, or 4%)). Thus, the minimum length of the bachelor's degree

for the typical completer was raised from 120 credits to 123 credits, in order to account

for the average potential loss of transfer credit. (Again, it is important to note that this is

likely a conservative estimate, since sophomores and juniors were not assumed to lose

any academic credit in the transfer process.)

The third set of adjustments for the typical completer case addressed time-to-

degree, or the rate of progression by which Maryland community college students

typically move through the two-year to four-year higher education pipeline, as reflected

by their enrollment status. The optimal completer case assumed two years of full-time

enrollment at a Maryland community college, followed by two-years of full-time

enrollment at a Maryland four-year college or university. In reality, however, attendance

patterns among Maryland community college transfer students substantially differ from

the representative optimal completer scenario in this study. In fall 2004, for example,

only 35% of Maryland community college students attended school full-time, while the

remaining 65% attended school part-time (MHEC, 2005a). (Part-time status for

undergraduate students is defined as enrollment in less than 12 credit hours per semester.)

Among Maryland community college students who transferred to a four-year public

institution within USM between fall 2004 and fall 2008, 68% attended school on a full-

time basis (five-year calculated average), while 32% attended school on a part-time basis (five-year calculated average) (USM, 2010). Thus, while the majority of Maryland community college students attend school on a part-time basis, the majority of these community college students who eventually transfer to a four-year institution end up attending school full-time. In calculating time-to-degree for the typical completer in the study, I made the following assumptions:

Full-time students (both at community colleges and four-year institutions) would complete an average of 30 credits per academic year.

Part-time students (both at community colleges and four-year institutions) would complete an average of 15 credits per academic year.

In the community college: 35% of the students (the percentage attending full-time) would complete the calculated point-of-transfer average of 46 credits in 1.5 years (46/30 =1.5), and 65% of the students (the percentage attending part-time) would complete the calculated point-of-transfer average of 46 credits in 3.1 years (46/15 = 3.1).

(1.5 years x .35 full-time attendee proportion) + (3.1 years x .65 part-time attendee proportion) = Blended average of 2.5 years in attendance at a community college.

In the four-year institution: 68% of the students (the percentage attending full-time) would complete the calculated average of the remaining 77 credits (74 + 3 to account for redundant coursework) in 2.6 years (77/30 = 2.6), and 32% of the students (the percentage attending part-time) would complete the calculated average of the remaining 77 credits in 5.1 years (77/15 = 5.1).

(2.6 years x .68 full-time attendee proportion) + (5.1 years x .32 part-time

attendee proportion) = Blended average of 3.5 years in attendance at a four-year

institution.

Average time-to-degree for the typical completer calculated at 6 years (2.5

equivalent years in attendance at a community college and 3.5 equivalent years in

attendance at a four-year institution) .

In addition to full-time versus part-time enrollment status, time-to-degree can also

be affected by the extent to which students are continuously enrolled in higher education

versus non-continuously enrolled (i.e., stopping out for a semester or longer en route to a

degree). Since it was not possible to account for every potential permutation of student

attendance patterns in these analyses, I examined several years of available time-to-

degree and transfer data for first-time, full-time freshman cohorts of Maryland

community college students (MHEC, 2010a), as well as cohorts of Maryland community

college students who transferred to a four-year USM institution in pursuit of a bachelor's

degree (MHEC, 2011; USM, 2010). These data revealed that the largest percentages of

Maryland community college students typically transferred after the second or third year

following their initial enrollment (MHEC, 2011), and that the largest percentages of

transfers then completed their bachelor's degree three or four years after transferring to a

four-year institution (USM, 2010). When taken together with available data on student

enrollment status (full-time versus part-time attendance), as described directly above, the

average time-to-degree estimate of six years for the typical completer seemed reasonable.

Therefore, the educational cost data for the typical completer case variations that

were presented in Tables 7, 8, 9, and 10 took into account the point at which Maryland

community college students typically transfer from a two-year institution to a four-year institution (average of 46 credits, which was the first set of adjustments), the potential for loss of credit during the transfer process (average of 3 credits, which was the second set of adjustments), and time-to-degree (average of 6 years, which was the third set of adjustments). The sources, assumptions, and calculations for these adjustments in each of the educational cost categories (tuition and fees, books and supplies, state subsidy, financial aid, and foregone earnings and taxes) are explained in the sections below.

Tuition and Fees

For the optimal completer case that was associated with the first research question in this chapter, the tuition and fees calculations were $2,880 for FY05 (first year of full-time enrollment in a community college), $3,030 for FY06 (second year of full-time enrollment in a community college), $9,252 for FY07 (third year of full-time enrollment in a public or independent four-year institution, using a blended tuition rate), and $9,581 for FY08 (fourth year of full-time enrollment in a public or independent four-year institution, using a blended tuition rate)—for a total of $24,743 in tuition and fees for four years of college enrollment. When considering the profile of the typical completer, however, one would not assume that this student would attend school full-time or spend the equivalent of two full years at a community college through the completion of an associate's degree. Rather, the more typical student profile revealed that the majority of Maryland community college students attend school part-time, and among those who transfer, the majority do so prior to their junior year without an earned associate's degree in hand (USM, 2009; USM, 2010).

As a result, the typical completer case required several adjustments to the tuition

and fees calculations, including the tuition rates charged (to reflect full-time

undergraduate versus part-time undergraduate tuition and fees rates as well as tuition

increases associated with longer time-to-degree), the point at which community college

students typically transfer from a two-year institution to a four-year institution, and the

potential for loss of credit during the transfer process. Using published institutional

tuition and fees rates (MHEC, 2006a, 2007a, 2008b, 2009a) and factoring in these

assumptions, the total costs for tuition and fees per typical completer in the study were

calculated at $30,721, as shown here:

Tuition and Fees Rate Adjustments:

35% of the students (percentage attending full-time prior to transfer) would pay

the FY05 and FY06 optimal community college tuition and fees base rate of

$5,910.

65% of the students (percentage attending part-time prior to transfer) would pay

the part-time tuition and fees rate of $104 per credit hour (weighted average of

part-time tuition and fees at Maryland community colleges, based on in-service

area and in-state rates, adjusted for inflation increases to reflect longer average

time-to-degree for the typical completer).

($5,910 x .35) + ($104 x 60 x .65) = $6,125.

68% of the students (percentage attending full-time following transfer) would pay

the FY07 and FY08 optimal four-year institution tuition and fees base rate of

$18,833.

32% of the students (percentage attending part-time following transfer) would

pay the part-time tuition and fees rate of $380 per credit hour (weighted average

of undergraduate part-time tuition and fees at Maryland four-year institutions

with teacher preparation programs, weighted by the likelihood of a student

transferring to a four-year public versus a four-year independent institution,

based on in-state resident rates, adjusted for inflation increases to reflect longer

time-to-degree).

($18,833 x .68) + ($380 x 60 x .32) = $20,102.

Point of Transfer Adjustments:

Community college tuition and fees: $6,125 x .24 proportional reduction (from

50% to 38% of the degree) = $4,655 in community college tuition and fees costs

for the typical completer.

Four-year institution tuition and fees: $20,102 x .24 proportional increase (from

50% to 62% of the degree) = $24,926 in four-year institution tuition and fees

costs for the typical completer.

Loss of Credit Adjustments:

$4,655 in tuition and fees for 46 credits at the community college + $24,926 in

tuition and fees for 74 credits at the four-year institution + ($380 x 3) for an

additional three credit hours at the four-year institution part-time tuition and fees

rate = $30,721.

Books and Supplies

For the optimal completer case that was associated with the first research question

in this chapter, the books and supplies totals were $745 during the first year of enrollment

in FY05 (at a Maryland community college), $775 during the second year in FY06 (at a Maryland community college), $884 during the third year in FY07 (at a Maryland four-year institution), and $919 during the fourth year in FY08 (at a Maryland four-year institution)—totaling $3,323 in expenses over four years of college enrollment. To derive the comparable cost data for the typical completer case, adjustments were made to the optimal completer data in order to account for the point at which community college students typically transfer from a two-year institution to a four-year institution (which would affect the pricing rate in the cost calculations), the potential for loss of credit during the transfer process (which would increase the overall base in the cost calculations), and time-to-degree (which would affect the inflation rate in the cost calculations). After making these adjustments, the total costs for books and supplies for the typical completer were calculated at $3,621, as shown here:

Point of Transfer Adjustments:

Community college books and supplies: ($745 + $775) x .24 proportional reduction (from 50% to 38% of the degree) from the optimal completer case = $1,155 in community college books and supplies for the typical completer.

Four-year institution books and supplies: ($884 + $919) x .24 proportional increase (from 50% to 62% of the degree) from the optimal completer case = $2,236 in four-year institution books and supplies for the typical completer.

Loss of Credit Adjustments:

$1,155 for books and supplies costs for 46 credits at the community college +

$2,236 for books and supplies costs for 74 credits at the four-year institution +

(($2,236/74) x 3) for books and supplies costs for an additional three credit hours

at the four-year institution books and supplies rate = $3,482.

Time-to-Degree Adjustments:

Applies an inflationary increase of 4% to the adjusted community college books

and supplies base (to reflect the increase in the average student time spent from 2

years to 2.5 years), and an inflationary increase of 4% to the adjusted four-year

institution books and supplies base (to reflect the increase in the average student

time spent from 2 years to 3.5 years), or (($1,155 + $1,155 x .04) + ($2,327 +

$2,327 x .04)) = $3,621.

State Subsidy

For the optimal completer case that was associated with the first research question

in this chapter, the calculated state subsidy was $20,226 for four years of college

enrollment—$2,086 during the first year in FY05 (at a Maryland community college),

$2,193 during the second year in FY06 (at a Maryland community college), $7,763

during the third year in FY07 (at a Maryland four-year institution), and $8,184 during the

fourth year in FY08 (at a Maryland four-year institution). Since the state subsidy funding

structure is different for four-year public institutions versus four-year independent

institutions in Maryland, the calculations were weighted by the likelihood of a Maryland

community college student transferring to one type of institution or the other. In the

benefit-cost framework in this study, it was assumed that Maryland taxpayers would fully

carry the costs associated with these subsidies to higher education.

To derive the comparable state subsidy data for the typical completer case,

adjustments were made to the optimal completer data in order to account for the point at

which community college students typically transfer from a two-year institution to a four-

year institution, the potential for loss of credit during the transfer process, and time-to-

degree. Unlike the cost categories for tuition and fees, financial aid, and foregone

earnings, no further adjustments were made to account for cost differentials specific to

part-time students, since subsidy rates were already based on FTE enrollments, and

therefore reflected support levels for both full-time and part-time students. After making

these adjustments to the optimal completer costs, the total state subsidy costs per typical

completer were calculated at $24,781, as shown here:

Point of Transfer Adjustments:

Community college state subsidy: ($2,086 + $2,193) x .24 proportional reduction

(from 50% to 38% of the degree) from the optimal completer case = $3,252 in

community college state subsidy costs to taxpayers for the typical completer.

Four-year institution state subsidy: ($7,763 + $8,184) x .24 proportional

increase (from 50% to 62% of the degree) from the optimal completer case =

$19,774 in four-year institution state subsidy costs to taxpayers for the typical

completer.

Loss of Credit Adjustments:

$3,252 for state subsidy costs for 46 credits at the community college + $19,774

for state subsidy costs for 74 credits at the four-year institution + (($19,774/74) x

3) for state subsidy costs for an additional three credit hours at the four-year

institution state subsidy rate = $23,828.

Time-to-Degree Adjustments:

Applies an inflationary increase of 4% to the adjusted community college base (to

reflect the increase in the average student time spent from 2 years to 2.5 years),

and an inflationary increase of 4% to the adjusted four-year institution base (to

reflect the increase in the average student time spent from 2 years to 3.5 years),

or (($3,252 + $3,252 x .04) + ($20,576 + $20,576 x .04)) = $24,781.

Financial Aid

For the optimal completer case, the total financial aid costs were $7,005 for

Maryland taxpayers and -$8,867 for pipeline participants over four years of full-time

college enrollment. (In this benefit-cost framework, financial aid costs were considered

to be an internal transfer payment between taxpayers and students.) Several adjustments

to the financial aid calculations were necessary for the typical completer, including the

point at which community college students typically transfer from a two-year institution

to a four-year institution, the potential for loss of credit during the transfer process, time-

to-degree, and adjustments for the proportion of financial aid that had already been

accounted for in the state subsidy costs in the benefit-cost analysis. The financial aid data

for the typical completer were drawn from reports generated from MHEC's Financial Aid

Information System (FAIS) and were based on the average financial aid package per

undergraduate student recipient in Maryland two-year and four-year public and

independent institutions (MHEC, 2006b, 2007c, 2008c, 2009c). The data were adjusted

by the likelihood of a student in the pipeline being a financial aid recipient, as well as the

likelihood of a student transferring to a four-year public versus a four-year independent institution. Loans were excluded from these analyses since students must repay them in the future, as were the specific financial aid categories of institutional grants and institutional scholarships, which were already assumed to have been accounted for in the state subsidy cost category in the benefit-cost framework.

The MHEC FAIS source data included financial aid categories that were available to undergraduate students in Maryland, and these amounts were apportioned by segment (two-year versus four-year, part-time versus full-time) in the calculations below. The total financial aid costs per typical completer were calculated at $8,627 for Maryland taxpayers and -$10,920 for pipeline participants over the equivalent of six years of college attendance (with a net cost to society of -$2,293), as shown here:

Point of Transfer Adjustments:

Community college financial aid: ($871 as FY05 base + $904 as FY06 base) x .24 proportional reduction (from 50% to 38% of the degree) = $1,349 in community college financial aid costs for the typical completer.

Four-year institution financial aid: ($3,492 as FY07 base + $3,600 as FY08 base) x .24 proportional increase (from 50% to 62% of the degree) = $8,794 in four-year institution financial aid costs for the typical completer.

Loss of Credit Adjustments:

$1,349 for financial aid costs for 46 credits at the community college + $8,794 for financial aid costs for 74 credits at the four-year institution + (($8,794/74) x 3) for financial aid costs for an additional three credit hours at the four-year institution financial aid rate = $10,500.

Time-to-Degree Adjustments:

Applies an inflationary increase of 4% to the adjusted community college base (to reflect the increase in the average student time spent from 2 years to 2.5 years), and an inflationary increase of 4% to the adjusted four-year institution base (to reflect the increase in the average student time spent from 2 years to 3.5 years), or (($1,349 + $1,349 x .04) + ($9,151 + $9,151 x .04)) = $10,920.

State Subsidy Adjustments to Financial Aid Amount:

Reduction of average financial aid award of $10,920 by 21% (proportion of institutional grants and institutional scholarships in total financial aid award amounts in FAIS) = $8,627.

Foregone Earnings and Taxes

For the optimal completer case, the total calculated foregone earnings amount was $63,143 for four years of full-time college enrollment. As explained earlier in this chapter, foregone earnings were adjusted downward (from the original calculated figure of $87,431) to account for the likelihood of a student working while being enrolled in college, which would offset a portion of the full foregone earnings costs. The data sources and assumptions for calculating foregone earnings for the typical completer were similar to that of the optimal completer, with two necessary adjustments. First, the time horizon for calculating foregone earnings was set at six years rather than four years (consistent with the time-to-degree calculation for the typical completer versus the optimal completer). Second, the amount of time that the typical completer was projected to work per week was adjusted to account for differences in employment patterns

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between students attending college full-time versus part-time (whereas the calculations for the optimal completer had assumed full-time college attendance).

For the typical completer, foregone earnings were calculated using the 2004 median weekly earnings of full-time wage and salary workers ages 25 years and over, by level of educational attainment and gender, from the *Current Population Survey* (Bureau of the Census, 2004a). In terms of level of educational attainment, students in the pipeline in this study were assumed to be high school graduates who had attended college but not yet attained a college degree. Identical to the calculations described in the optimal completer section above, adjustments for gender distribution in the educational pipeline, student age, and employment rates were applied, and the foregone earnings base was set at $20,589 for the student's first year of college attendance in FY05. Applying a 4% increase over five subsequent years of college enrollment (for the typical completer) yielded a foregone earnings total of $136,566 over six years of college attendance, or ($20,589 for Year 1 + $21,413 for Year 2 + $22,269 for Year 3 + $23,160 for Year 4 + $24,086 for Year 5 + $25,049 for Year 6).

The use of salary data for fully employed individuals would likely overestimate the total costs of foregone earnings in this study since many students still work, either part-time or full-time, while they are enrolled in college. Thus, undergraduate student employment data from NCES were considered to determine the extent to which the full amount of foregone earnings should be reduced to account for student employment (Aud, et al., 2011). Using NCES data, the four-year figure that was previously calculated for foregone earnings ($136,566) was adjusted downward to account for the likelihood of a

student in the pipeline working while attending either a two-year or four-year institution, as well as the average number of hours worked per week.

Since the point of entry into the typical completer pipeline was positioned during the 2004-2005 academic year in this study, I drew upon national student employment data for both full-time and part-time undergraduate students in 2005, as reported by NCES (Aud, et al., 2011). (The previous foregone earnings calculations for the optimal completer used student employment data from this same source, but for full-time undergraduates only.) According to these figures, 52% of full-time undergraduate students were not employed, 18% were employed and working less than 20 hours per week, 21% were employed and working 20 to 34 hours per week, and 9% were employed and working 35 hours or more per week. In addition, 16% of part-time undergraduate students were not employed, 10% were employed and working less than 20 hours per week, 27% were employed and working 20 to 34 hours per week, and 47% were employed and working 35 hours or more per week. These data included community college students as well as students enrolled in four-year public and independent institutions. Since students in the typical completer pipeline study were assumed to attend both a two-year institution and a four-year institution (either public or independent) over the course of their six years of college enrollment, aggregated earnings percentages for full-time and part-time undergraduates across all higher education sectors were applied in the analysis.

Applying the weights that were derived from the NCES data (Aud, et al., 2011) to the previously calculated six-year foregone earnings total of $136,566, I made the following assumptions:

During the typical completer's 2.5 equivalent years of enrollment at the

community college, there was a 35% chance of full-time attendance and a 65%

chance of part-time attendance (MHEC, 2005a). Students would be eligible to

earn Year 1, Year 2, and half of the Year 3 projected foregone earnings during

this time period, totaling $53,137.

During the typical completer's 3.5 equivalent years of enrollment at the four-year

institution, there was a 68% chance of full-time attendance and a 32% chance of

part-time attendance (USM, 2010). Students would be eligible to earn half of the

Year 3 and all of the Year 4, 5, and 6 projected foregone earnings during this time

period, totaling $83,429.

Among typical completers in the pipeline who were enrolled in school full-time,

there was a 52% probability that the typical completer was earning nothing to

offset the total foregone earnings; an 18% probability that the typical completer

was earning 25% of the foregone earnings (working 0 to 20 hours per week,

assuming a range midpoint of 10 hours, or 25% of a 40-hour work week); a 21%

probability that the typical completer was earning 68% of the foregone earnings

(working 20 to 34 hours per week, assuming a range midpoint of 27 hours, or

68% of a 40-hour work week); and a 9% probability that the typical completer

was earning 100% of the foregone earnings (working 35 or more hours per week)

(Aud, et al., 2011).

Among typical completers in the pipeline who were enrolled in school part-time,

there was 16% probability that the typical completer was earning nothing to

offset the total foregone earnings; a 10% probability that the typical completer

was earning 25% of the foregone earnings (working 0 to 20 hours per week,

assuming a range midpoint of 10 hours, or 25% of a 40-hour work week); a 27%

probability that the typical completer was earning 68% of the foregone earnings

(working 20 to 34 hours per week, assuming a range midpoint of 27 hours, or

68% of a 40-hour work week); and a 47% probability that the typical completer

was earning 100% of the foregone earnings (working 35 or more hours per week)

(Aud, et al., 2011).

These weights and calculations yielded a total of $28,604 in undergraduate student earnings concurrent with full-time or part-time enrollment during the typical completer's 2.5 years at the community college, or ((($0 x .52) + ($53,137 x .18 x .25) + ($53,137 x .21 x .68) + ($53,137 x .09 x 1.00) x .35)) + (($0 x .16) + ($53,137 x .10 x .25) + ($53,137 x .27 x .68) + ($53,137 x .47 x 1.00) x .65))). Further, the calculations yielded a total of $33,877 in undergraduate student earnings concurrent with full-time or part-time enrollment during the typical completer's 3.5 years at the four-year institution, or ((($0 x .52) + ($83,429 x .18 x .25) + ($83,429 x .21 x .68) + ($83,429 x .09 x 1.00) x .68)) + (($0 x .16) + ($83,429 x .10 x .25) + ($83,429 x .27 x .68) + ($83,429 x .47 x 1.00) x .32))). When subtracting the total student employment earnings of $62,481 (which included earnings both at the community college and at the four-year institution, adjusted by student enrollment status, student likelihood of working, and average hours worked per week) from the previously projected six-year foregone earnings amount of $136,566, the total foregone earnings stream for the typical completer was $74,085. Consistent with the previous methods used for calculating taxes on income (see "Calculation of Benefits for the Optimal Completer Case" section), a blended Maryland

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state tax rate of 7.57% was applied to the adjusted foregone earnings stream of $74,085,

totaling $5,608 in foregone tax revenues for the state.

Net Present Value for the Typical Completer Case

The second research question in this study addressed the benefits and costs that

were associated with the typical transfer student pipeline in teacher preparation between

Maryland community colleges and Maryland four-year institutions. Like the optimal

completer case in the previous section, the typical completer still attained a bachelor's

degree in education. However, this case reflected the average rate at which community

college students typically progress through and complete this two-year to four-year

pipeline, as well as the average point at which they typically transfer. Four variations of

the typical completer case were considered in order to account for a range of post-

graduate employment outcomes, resulting in benefits calculations for maximum returns

to teaching (assuming that some graduates would spend their entire career in the teaching

profession in Maryland); expected returns to teaching (assuming that some graduates

would spend a portion of their career in the teaching profession in Maryland, but not their

entire career); alternate returns to teaching (assuming that some graduates in the pipeline

would not enter teaching, but choose to hold employment in another career field in

Maryland); and no returns to teaching (assuming that some graduates in the pipeline

would leave Maryland altogether to pursue post-graduate employment, either in teaching

or in an alternate career field). Using 2004-2005 as the baseline year for initial entry into

the higher education pipeline, the calculated net present values for the typical completer

case were $772,832 for maximum returns to teaching (Table 7), $908,846 for expected

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returns to teaching (Table 8), $986,305 for alternate returns to teaching (Table 9), and $929,509 for no returns to teaching (Table 10).

Research Question 3: Non-Completer Case

The third research question in this study addresses the benefits and costs that are associated with non-completion in the teacher preparation transfer pipeline between Maryland community colleges and Maryland four-year institutions. Whereas the optimal completer case represented the upper limits of efficiency in this pipeline (Research Question 1), and the typical completer case represented its more usual efficiency (Research Question 2), the non-completer case represents the lower limits of efficiency in this pipeline through premature departure prior to bachelor's degree completion. Using the same economic benefit-cost framework from Table 2 in the previous chapter, Tables 11, 12, 13, and 14 document the benefits and costs for four representative types of student "non-completers" in the study. Unlike students in the optimal and typical categories, who were assumed to remain in the pipeline through attainment of a bachelor's degree in education (albeit at varying rates of progression), non-completers are assumed to initially enter this pipeline in a Maryland community college through an AA or AAT degree program, but to exit this pipeline at some point prior to attaining a bachelor's degree at a Maryland four-year institution.

Four types of non-completers are considered as part of this research question, in order to capture a range of potential outcomes in the student pipeline: attrition directly following an earned associate's degree at a community college; attrition prior to attaining an associate's degree at a community college; attrition following transfer with an earned associate's degree from a community college, but prior to attaining a bachelor's degree;

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and attrition following transfer without an associate's degree from a community college, but prior to attaining a bachelor's degree. Since students in this pipeline would not be expected to pursue K-12 teaching as a profession (and in fact would be ineligible for state certification due to not having attained a bachelor's degree), all future earnings are assumed to come from alternate career fields, commensurate with the projected level of educational attainment for each non-completer case variation. Data sources and calculations for the benefits and costs that are associated with each of these four variations of non-completers are explained after Tables 11 through 14 are presented.

Table 11

Benefits/Costs for the Non-Completer Case: Attrition Following an Associate's Degree

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income			
Future Alternate Income	496,056		496,056
Future Taxes		28,198	28,198
Total Benefits	496,056	28,198	524,254
Educational Costs			
Tuition and Fees	6,125		6,125
Books and Supplies	1,601		1,601
State Subsidy		4,506	4,506
Financial Aid	-1,869	1,477	-392
Foregone Earnings	28,882		28,882
Foregone Taxes		2,186	2,186
Total Costs	34,739	8,169	42,908
Net Present Value	461,317	20,029	481,346

Table 12

Benefits/Costs for the Non-Completer Case: Attrition Prior to an Associate's Degree

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income			
Future Alternate Income	299,400		299,400
Future Taxes		17,130	17,130
Total Benefits	299,400	17,130	316,530
Educational Costs			
Tuition and Fees	1,225		1,225
Books and Supplies	320		320
State Subsidy		901	901
Financial Aid	-374	295	-79
Foregone Earnings	5,776		5,776
Foregone Taxes		437	437
Total Costs	6,947	1,633	8,580
Net Present Value	292,453	15,497	307,950

Table 13

Benefits/Costs for the Non-Completer Case: Attrition Following Transfer with an Associate's Degree, Prior to Earning a Bachelor's Degree

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income			
Future Alternate Income	496,056		496,056
Future Taxes		28,198	28,198
Total Benefits	496,056	28,198	524,254
Educational Costs			
Tuition and Fees	10,149		10,149
Books and Supplies	1,993		1,993
State Subsidy		7,976	7,976
Financial Aid	-3,412	2,696	-716
Foregone Earnings	36,917		36,917
Foregone Taxes		2,794	2,794
Total Costs	45,647	13,466	59,113
Net Present Value	450,409	14,732	465,141

Table 14

Benefits/Costs for the Non-Completer Case: Attrition Following Transfer without an Associate's Degree, Prior to Earning a Bachelor's Degree

	Individuals	Taxpayers (MD)	Net Society
Benefits Premium			
Future Teaching Income			
Future Alternate Income	299,400		299,400
Future Taxes		17,130	17,130
Total Benefits	299,400	17,130	316,530
Educational Costs			
Tuition and Fees	5,249		5,249
Books and Supplies	712		712
State Subsidy		4,371	4,371
Financial Aid	-1,917	1,514	-403
Foregone Earnings	13,811		13,811
Foregone Taxes		1,045	1,045
Total Costs	17,855	6,930	24,785
Net Present Value	281,545	10,200	291,745

Calculation of Benefits for the Non-Completer Case

In Table 11, the benefits for a Maryland community college AA or AAT degree recipient (who did not subsequently transfer to a four-year institution) were calculated over a 33-year period, consistent with the time horizon for career earnings for degree holders in the optimal completer and typical completer cases. (The methodology that was used for the worklife expectancy calculations was described earlier in this chapter.) In all four variations of the non-completer case, earnings were assumed to come from alternate employment routes outside of teaching in Maryland, since these students would not be eligible to teach without an earned bachelor's degree. The baseline year for the salary calculations in Table 11 was 2008, assuming that the non-completer had begun his or her studies at a community college during the 2004-2005 academic year, and had graduated with an associate's degree within a four-year average time period. (A detailed justification for setting four years as the average time-to-degree for the associate's degree holder is provided in the tuition and fees cost calculations section below.)

The baseline figures for these salary calculations were the median annual earnings for associate's degree holders ages 25 and older in the United States in 2008, which were $50,150 for males and $36,760 for females, according to *Current Population Survey* data (U.S. Bureau of the Census, 2008). Adjustments were necessary to account for student age, since the reported median annual earnings for individuals ages 25 and older (who presumably would represent a wide range of points in their careers) would likely over-predict the beginning salary for new associate's degree holders. According to estimates from the *Current Population Survey* earnings patterns for workers ages 16 to 24, males could be expected to earn 54% of the ages 25 and over full salary figure, while females

could be expected to earn 63% of the ages 25 and over full salary figure (Bureau of the

Census, 2008). Applying these weights, salary estimates of $27,081 ($50,150 x .54) were

derived for male associate's degree recipients ages 16 to 24 in the Maryland pipeline, and

$23,159 ($36,760 x .63) for female associate's degree recipients ages 16 to 24 in the

Maryland pipeline.

Further, using previous assumptions employed by Christophersen and Robison

(2003) in their study of the economic impact of Maryland community colleges, half of

the student pipeline in this study was assumed to be ages 25 years and older, while the

other half was assumed to be under the age of 25. Arriving at a blended average salary

rate for this case variation, the starting salary for male associate's degree holders was

calculated as $38,616 (with 50% of male associate's degree graduates earning $50,150,

on average, and 50% of male associate's degree graduates earning $27,081, on average),

while for females, it was calculated as $29,960 (with 50% of female associate's degree

graduates earning $36,760, on average, and 50% of female associate's degree graduates

earning $23,159, on average).

In order to account for gender distribution in the pipeline, an additional set of

calculations was necessary to derive future earnings. Based on the demographic data of

professional teaching staff in Maryland public schools (MSDE, 2008a), 23% of the

community college students in the pipeline were predicted to be male and 77% were

predicted to be female. As was the case for the optimal completer and typical completer

cases, I assumed that the higher education pipeline in teacher education would mirror the

gender demographics of the teaching workforce over time, although data for Maryland-

prepared teacher candidates from the previous academic year (2006-2007) were slightly

more skewed toward females, at 81% (MSDE, 2008a). Since more detailed enrollment,

retention, and completion data by gender were unavailable for the teacher preparation

transfer pipeline, the Maryland teacher workforce gender demographics were used as a

proxy in the analysis. Applying these weights to the salary figures above yielded a

blended starting salary rate of $31,952 for associate's degree holders in the study

(($38,616 x .23 for males) + ($29,960 x .77 for females)). These calculations yielded a

33-year benefits stream with a starting salary of $31,952 in 2008-2009 and an ending

salary of $112,089 in 2040-2041, assuming an annual salary increase of 4%. When

applying a discount rate of 4% to all future earnings, the 33-year total income stream was

reduced from $2,115,527 (undiscounted) to $1,054,416 (discounted).

Since benefits in human investment benefit-cost studies are tied to the level of

education attained (an associate's degree in this variation of the non-completer case)

versus potential benefits which program participants would have otherwise accrued,

further adjustments were required to the future income stream in Table 11. Namely, a

future income "premium" was calculated to reflect the true value of the educational

benefit under consideration, which, in this case, was the difference between future

income that was projected to accrue from earning an associate's degree versus earning a

high school diploma. In order to make these adjustments, I considered the median annual

earnings for high school graduates (who had neither attended college nor earned a college

degree) ages 25 and older in the United States in 2008, according to *Current Population

Survey* data (U.S. Bureau of the Census, 2008), making necessary adjustments to account

for student age, gender, and worklife expectancy. Identical to the benefits premium

assumptions and calculations for the optimal completer and typical completer cases

earlier in this chapter, the comparable high school benefits stream was calculated for 30 years at $1,043,853 (undiscounted) and $558,360 (discounted). Calculating the difference between the discounted income stream for associate's degree recipients ($1,054,416) and the discounted income stream for high school graduates ($558,360), the total earnings premium for this first variation of the non-completer case was $496,056, as shown in Table 11.

In calculating the revenue stream from future taxes on the benefits premium presented in Table 11, an aggregate rate of 7.57% was applied to the $496,056 total, yielding $37,551 in state tax revenues. Adjustments were then made to this figure to account for the likelihood of an associate's degree recipient initially working in Maryland and the effects of out-of-state worker mobility over time. When weighting the total tax revenues by the likelihood of a community college student graduate in Maryland (80%) (MHEC, 2007d), as well as the net effects of outmigration from the state (.4% in years 2 through 33 of the discounted tax benefits stream) (GWIB, 2008), the 33-year discounted total in state tax revenues was reduced from $37,551 to $28,198.

In Table 12, the benefits for the case variation of the Maryland community college student who left school prior to attaining an AA or AAT degree (and who did not subsequently transfer to a four-year institution) were calculated over a 30-year period, consistent with the time horizon for non college degree holders in the optimal completer and typical completer cases. (The methodology that was used for the worklife expectancy calculations was described earlier in this chapter.) The baseline year for the salary calculations in Table 12 was 2008, assuming that this second variation of the non-completer had begun his or her studies at a community college during the 2004-2005

academic year, and had left school without graduating or transferring within a four-year average time period.

The baseline figures for these salary calculations were the median annual earnings for high school graduates with some college (but no earned college degree) ages 25 and older in the United States in 2008, which were $45,820 for males and $32,630 for females, according to *Current Population Survey* data (U.S. Bureau of the Census, 2008). Adjustments were necessary to account for student age, since the reported median annual earnings for individuals ages 25 and older (who presumably would represent a wide range of points in their careers) would likely over-predict the beginning salary for these students. According to estimates from the *Current Population Survey* earnings patterns for workers ages 16 to 24, males could be expected to earn 54% of the ages 25 and over full salary figure, while females could be expected to earn 63% of the ages 25 and over full salary figure (Bureau of the Census, 2008). Applying these weights, salary estimates of $24,743 ($45,820 x .54) were derived for this variation of non-completing males ages 16 to 24, and $20,557 ($32,630 x .63) for this variation of non-completing females ages 16 to 24.

Further, using previous assumptions employed by Christophersen and Robison (2003) in their study of the economic impact of Maryland community colleges, half of the student pipeline in this study was assumed to be ages 25 years and older, while the other half was assumed to be under the age of 25. Arriving at a blended average salary rate for this case, the starting salary for this second variation of non-completing males in the study was calculated as $35,282 (with 50% of males earning $45,820, on average, and 50% of males earning $24,743, on average), while for females, it was calculated as

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$26,594 (with 50% of females earning $32,630, on average, and 50% of females earning $20,557, on average).

In order to account for gender distribution in the pipeline, an additional set of calculations was necessary to derive future earnings. Based on the demographic data of professional teaching staff in Maryland public schools (MSDE, 2008a), 23% of the community college students in the pipeline were predicted to be male and 77% were predicted to be female. Applying these weights to the salary figures above yielded a blended starting salary rate of $28,592 for students who left the pipeline prior to attaining an associate's degree (($35,282 x .23 for males) + ($26,594 x .77 for females)). These calculations yielded a 30-year benefits stream with a starting salary of $28,592 in 2008-2009 and an ending salary of $89,168 in 2037-2038, assuming an annual salary increase of 4%. When applying a discount rate of 4% to all future earnings, the 30-year total income stream was reduced from $1,603,581 (undiscounted) to $857,760 (discounted).

Since benefits in human investment benefit-cost studies are tied to the level of education attained (which was projected to be some college in this variation of the non-completer case) versus potential benefits which program participants would have otherwise accrued, further adjustments were required to the future income stream in Table 12. Namely, a future income "premium" was calculated to reflect the true value of the educational benefit under consideration, which, in this case, was the difference between future income that was projected to accrue from attending some college (but not earning an associate's degree or bachelor's degree) versus earning a high school diploma. In order to make these adjustments, I considered the median annual earnings for high school graduates (who had neither attended college nor earned a college degree) ages 25

and older in the United States in 2008, according to *Current Population Survey* data (U.S.

Bureau of the Census, 2008), making necessary adjustments to account for student age,

gender, and worklife expectancy. Identical to the benefits premium assumptions and

calculations for the optimal completer and typical completer cases earlier in this chapter,

the comparable high school benefits stream was calculated for 30 years at $1,043,853

(undiscounted) and $558,360 (discounted). Calculating the difference between the

discounted income stream for students in the pipeline who had attended college but not

earned a degree ($857,760) and the discounted income stream for high school graduates

($558,360), the total earnings premium for the second variation of the non-completer case

was $299,400, as shown in Table 12.

In calculating the revenue stream from future taxes on the benefits premium

presented in Table 12, an aggregate rate of 7.57% was applied to the $299,400 total,

yielding $22,665 in state tax revenues. Adjustments were then made to this figure to

account for the likelihood of this student working in Maryland and the effects of out-of-

state worker mobility over time. When weighting the total tax revenues by the likelihood

of a community college student working in Maryland (80%) (MHEC, 2007d), as well as

the net effects of outmigration from the state (.4% in years 2 through 30 of the discounted

tax benefits stream) (GWIB, 2008), the 30-year discounted total in state tax revenues was

reduced from $22,665 to $17,130.

Table 13 represented the third variation of the non-completer student case, who

earned an AA or AAT degree from a Maryland community college and transferred to a

public or independent four-year college or university, but did not subsequently complete

a bachelor's degree. All future earnings were assumed to accrue from alternate

employment routes outside of teaching in Maryland, and were based on median annual

earnings for associate's degree holders in the workforce in 2008 (Bureau of the Census,

2008). In this case, the projected benefits premium was identical to the benefits premium

for the first variation of the non-completer case (presented in Table 11), since the

associate's degree was the highest degree attained, and future earnings were assumed to

be commensurate with the highest level of educational attainment above a high school

diploma. The data sources, underlying assumptions, and calculations were consistent

with those explained above for Table 11, yielding a 33-year discounted earnings premium

of $496,056 and a 33-year discounted tax revenue stream of $28,198, the latter of which

was adjusted for the likelihood of working in Maryland (MHEC, 2007d) and the effects

of outmigration from the state over time (GWIB, 2008).

Table 14 represented the fourth variation of the non-completer student case, who

attended a Maryland community college without earning an associate's degree, and then

subsequently transferred to public or independent four-year college or university without

earning a bachelor's degree. All future earnings were assumed to accrue from alternate

employment routes outside of teaching in Maryland, and were based on median annual

earnings for individuals with some college education (but no college degree) who were in

the workforce in 2008 (Bureau of the Census, 2008). In this case, the projected benefits

premium was identical to the benefits premium for the second variation of the non-

completer case (presented in Table 12), since future earnings were assumed to be

commensurate with the student's level of educational attainment above a high school

diploma (which, in this case variation, was college attendance but no earned associate's

degree or bachelor's degree). The data sources, underlying assumptions, and calculations

were consistent with those explained above for Table 12, yielding a 30-year discounted earnings premium of $299,400 and a 30-year discounted tax revenue stream of $17,130, the latter of which was adjusted for the likelihood of working in Maryland (MHEC, 2007d) and the effects of outmigration from the state over time (GWIB, 2008).

Calculation of Costs for the Non-Completer Case

While the cost calculations for the optimal completer (Research Question 1) and typical completer (Research Question 2) were not projected to vary within cases (as students within each case category were assumed to follow a uniform path through the higher education pipeline), the cost calculations were projected to vary across the four types of non-completer cases in the study. All non-completers were assumed to drop out of the two-year to four-year teacher preparation transfer pipeline prior to the completion of a bachelor's degree, albeit at different points in time. Since the data sources, underlying assumptions, and cost calculations were unique for each of the four sub-categories of non-completers, they were treated as such in the sections that follow in this chapter, including the costs related to attrition directly following an earned associate's degree from a Maryland community college (Table 11); costs related to attrition prior to attaining an associate's degree from a Maryland community college (Table 12); costs related to attrition following transfer with an earned associate's degree from a Maryland community college, but prior to attaining a bachelor's degree from a four-year institution (Table 13); and costs related to attrition following transfer without an associate's degree from a Maryland community college, but prior to attaining a bachelor's degree from a four-year institution (Table 14).

Attrition Following an Associate's Degree

Table 11 presented the benefits and costs for the non-completer student who earned an AA or AAT degree at a Maryland community college, but did not continue on to the bachelor's degree portion of the teacher preparation pipeline at a Maryland four-year public or independent institution. The costs in each category for this first variation of the non-completer were calculated as follows:

Tuition and Fees

Projecting that 35% of the pipeline non-completers in this first case variation would be enrolled in a Maryland community college on a full-time basis, and the remaining 65% would be enrolled on a part-time basis (MHEC, 2005a), I made the following assumptions:

Full-time community college students would complete an average of 30 credits per academic year.

Part-time community college students would complete an average of 15 credits per academic year.

35% of the students (the percentage attending full-time) would complete an average of 60 credits in 2.0 years (since 60/30 = 2.0), and 65% of the students (the percentage attending part-time) would complete an average of 60 credits in 4.0 years (since 60/15 = 4.0).

(2.0 years x .35 full-time students) + (4.0 years x .65 part-time students) =

Blended average of 3.3 years in attendance at a community college.

Consistent with the student cohort-based approach used throughout this benefit-cost study (i.e., setting the baseline academic year at 2004-2005), the statewide weighted

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average full-time tuition and fees rate was set at $2,880 for students enrolled in Maryland

community colleges in FY05, and $3,030 in FY06, or $5,910 over two years of college

enrollment (MHEC, 2006a, 2007a). As previously calculated for the typical completer,

the statewide weighted average part-time tuition and fees rate was $104 per credit hour,

which included two inflationary increases of 4% each beyond the FY05 and FY06

baseline rates (MHEC, 2006a, 2007a, 2008b, 2009a). (In this case, while lengthened

time-to-degree did not mean that part-time students would have to pay for additional

credits over the fixed amount for an associate's degree, they would have to pay a higher

tuition and fees rate per credit hour than full-time students, on average, since institutional

rates increased during each subsequent year of enrollment.) These calculations yielded a

weighted total of $6,125 in tuition and fees for the associate's degree recipient in this first

case variation, calculated as: ($5,910 in tuition x .35 full-time students) + (($104 in

tuition per credit hour x 60 credits) x .65 part-time students).

Books and Supplies

For the optimal completer and typical completer case calculations above, the

baseline books and supplies totals for Maryland community college students were $745

in FY05 and $775 in FY06, based on national College Board (2004) data. For associate's

degree recipients in this first non-completer case variation, I assumed that 35% of the

students (those attending full-time) would spend an average of $1,520 on books and

supplies (using the FY05 and FY06 baseline rates), while the remaining 65% of the

students (those attending part-time) would spend an average of $1,644, using the FY05

and FY06 baseline rates and applying two inflationary increases of 4% each to reflect two

additional years of college attendance. (Part-time community college students were not

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projected to take more courses overall than full-time students, but rather, to pay more for books and supplies per course, on average, due to their longer time span of college attendance.) These assumptions yielded a weighted total of $1,601 in books and supplies expenses for the associate's degree recipient in this first non-completer case variation, calculated as: ($1,520 in books and supplies x .35 full-time students) + ($1,644 in books and supplies x .65 part-time students).

State Subsidy

Using the same data sources and methods that were documented for the optimal completer and typical completer cases earlier in this chapter, the total calculated state subsidy was $2,086 per Maryland community college FTE student in FY05 and $2,193 in FY06, or $4,279 for the equivalent of two years of college enrollment (MACC, 2006, 2007). For associate's degree recipients in this first non-completer case variation, I assumed that the state subsidy for 35% of the students (those attending full-time) would be $4,279 (using the FY05 and FY06 baseline rates), while the state subsidy for the remaining 65% of the students (those attending part-time) would be $4,628, using the FY05 and FY06 baseline rates and applying two inflationary increases of 4% each to reflect two additional years of college attendance. No further adjustments were made to account for cost differentials specific to part-time students, since state subsidy rates were already based on FTE enrollments, and therefore reflected support for both full-time and part-time community college students. These assumptions yielded a state subsidy total of $4,506 for the associate's degree recipient in this first non-completer case variation, calculated as: ($4,279 in state subsidy costs x .35 full-time students) + ($4,628 in state subsidy costs x .65 part-time students). In the benefit-cost framework in this study, it was

assumed that Maryland taxpayers would fully carry the costs associated with the state subsidy to higher education.

Financial Aid

Using the same data sources and methods that were documented for the optimal completer and typical completer cases earlier in this chapter, the total calculated financial aid amount was $1,775 for Maryland community college students enrolled during the equivalent of two years in FY05 and FY06. The financial aid amounts were drawn from MHEC's FAIS source data (MHEC, 2006b, 2007c) and were weighted by the likelihood of a student in the pipeline being a financial aid recipient, as well as the proportion of financial aid sources that were available to full-time undergraduates versus part-time undergraduates. All undergraduate student loan sources were excluded from the financial aid totals in the study, since students must repay them in the future.

For associate's degree recipients in this first non-completer case variation, I assumed that the total financial aid costs for 35% of the students (those attending full-time) would be $1,775 (using the FY05 and FY06 baseline rates), while the total financial aid costs for the remaining 65% of the students (those attending part-time) would be $1,920, using the FY05 and FY06 baseline rates and applying two inflationary increases of 4% each to reflect two additional years of college attendance. No further adjustments were made to account for financial aid cost differentials specific to part-time students, since weighted amounts for part-time students were already included in the prior per-recipient calculations. These assumptions yielded a financial aid total of $1,869 for the associate's degree recipient in this first non-completer case variation, calculated as: ($1,775 x .35) + ($1,920 x .65).

In reducing the financial aid total of $1,869 by a factor of 21% to remove the specific financial aid sources of institutional grants and institutional scholarships (which were already assumed to have been accounted for in the state subsidy cost category), the adjusted financial aid total was $1,477 per pipeline participant. In the benefit-cost framework in this study, financial aid costs were considered to be an internal transfer payment between Maryland taxpayers and students in the pipeline. Thus, the total financial aid costs were $1,477 for Maryland taxpayers (with this total having been adjusted downward to avoid double-counting state subsidy costs), and -$1,869 for pipeline participants (who would receive the unadjusted financial aid total to offset educational costs), with a net cost to society of -$392.

Foregone Earnings and Taxes

Foregone earnings were calculated using the 2004 median weekly earnings of full-time wage and salary workers ages 25 years and over, by level of educational attainment and gender, from the *Current Population Survey* (Bureau of the Census, 2004a). In terms of level of educational attainment, students in the pipeline in this non-completer case variation were assumed to be high school graduates who had attended some college but had not yet attained a college degree. Identical to the calculations described in the optimal completer and typical completer sections above, adjustments for gender distribution in the educational pipeline, student age, and employment rates were applied, and the foregone earnings base was set at $20,589 for the student's first year of college attendance in FY05. Applying a 4% annual increase to this earnings base for one additional year of college enrollment (for the full-time AA or AAT student in this case variation) yielded a foregone earnings total of $42,002 over two years of community

college attendance, or ($20,589 for Year 1 + $21,413 for Year 2). Further, applying a 4%

annual increase to these earnings over two additional years of college enrollment (for the

part-time AA or AAT student in this case variation) yielded a foregone earnings total of

$87,431 over four years of community college attendance, or ($20,589 for Year 1 +

$21,413 for Year 2 + $22,269 for Year 3 + $23,160 for Year 4). Adjusting these earnings

to account for community college student attendance status (projected as 35% of students

attending school full-time and 65% of students attending school part-time, see MHEC,

2005a) yielded a blended foregone earnings total of $71,531.

Since the use of earnings data for fully employed individuals would likely

overestimate the total costs of foregone earnings in this study since many students still

work while enrolled in college, undergraduate student employment data from NCES

(Aud, et al., 2011) were considered to determine the extent to which the full amount of

foregone earnings should be reduced to account for student employment earnings

concurrent with college enrollment. Using the same NCES data that were applied to the

foregone earnings calculations in the optimal completer and typical completer cases, the

calculated foregone earnings for the non-completer case were adjusted downward to

account for the likelihood of a student in the pipeline working while attending college

either full-time or part-time, as well as the average number of hours worked per week,

weighted by college attendance status.

Applying weights from the NCES data (Aud, et al., 2011) to the previously

calculated foregone earnings totals of $42,002 for full-time community college students

and $87,431 for part-time community college students in this first non-completer case

variation (see the previous optimal completer and typical completer case sections for a full discussion of the derivation of these weights), I made the following adjustments:

For community college students attending school full-time (spending an average of two years): ($0 x .52) + ($42,002 x .18 x .25) + ($42,002 x .21 x .68) + ($42,002 x .09 x 1.00) = $11,668 in projected student earnings concurrent with full-time enrollment.

For community college students attending school part-time (spending an average of four years): ($0 x .16) + ($87,431 x .10 x .25) + ($87,431 x .27 x .68) + ($87,431 x .47 x 1.00) = $59,331 in projected student earnings concurrent with part-time enrollment.

($11,668 in student earnings x .35 full-time students) + ($59,331 in student earnings x .65 part-time students) = Blended student earnings average of $42,649 concurrent with full-time or part-time community college enrollment, weighted by the likelihood of working and the number of hours worked per week.

When subtracting the total student employment earnings of $42,649 from the previously projected foregone earnings amount of $71,531, the total foregone earnings stream for this first variation of the non-completer case was $28,882. Consistent with the previous methods used for calculating taxes on income, a blended Maryland state tax rate of 7.57% was applied to the foregone earnings stream, totaling $2,186 in foregone tax revenues for the state.

Attrition Prior to an Associate's Degree

Table 12 represented the second variation of the non-completer case, which was a community college student who exited the higher education pipeline prior to attaining an

AA or AAT degree at a Maryland community college, and did not subsequently transfer to a Maryland four-year public or independent institution. Since it was not possible to develop a single case that represented all stages of student attrition from the community college portion of the teacher preparation transfer pipeline (and no statewide average "point of attrition" proxies or statistics were available), I set the point of attrition at the minimum required credit count for community college students to be considered as part of the transfer pipeline, which was 12 credits. (Community college students who completed less than 12 credits would be classified as first-time freshmen instead of transfer students if they continued on to a four-year institution.) In contrast to the optimal completer case, which represented the upper limits of economic efficiency in the Maryland teacher preparation transfer pipeline, this particular variation of the non-completer case represented the lower limits of educational attainment in the pipeline. Thus, it is important to acknowledge that these projections may have actually underestimated the educational costs for non-completers who did not attain an associate's degree, thereby inflating the net present value for this case variation.

Taking the cost figures that were calculated for full associate's degree recipients in Table 11, and projecting that this variation of the non-completer's 12 credits would be completed at some point during the 2004-2005 academic year or thereafter, I applied a weighting factor of 20% (12 of 60 associate's degree credits) to the figures in each of the educational cost categories in Table 11. These new cost calculations for attrition prior to the associate's degree, which were presented in Table 12, yielded a total of $1,225 for tuition and fees (reduced from $6,125), $320 for books and supplies (reduced from $1,601), $901 for the state subsidy (reduced from $4,506), -$374 for financial aid for

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students (reduced from -$1,869), $295 for financial aid for taxpayers (reduced from $1,477), $5,776 for foregone earnings (reduced from $28,882), and $437 for foregone taxes (reduced from $2,186).

Attrition Following Transfer with Associate's, Prior to Earning Bachelor's

Table 13 represented the third variation of the non-completer case, which was a community college student who transferred with an earned associate's degree from a Maryland community college to a Maryland four-year public or independent institution, but did not ultimately complete the bachelor's degree. Since it was not possible to develop a single case that represented all stages of community college transfer student attrition from the four-year institution portion of the teacher preparation transfer pipeline (and no statewide average "point of attrition" proxies or statistics were available), I utilized the 12 credit attrition figure that was included in cost projections in Table 12 (the minimum required credit count for community college students to be considered as part of the transfer pipeline). Again, the non-completer case was designed to represent the low end of efficiency and attainment in the two-year to four-year teacher transfer pipeline, so, in the absence of more precise data, the 12 credit attrition projection was used as a bottom range estimate in the analysis. It is important to acknowledge, however, that these projections may have actually underestimated the educational costs and inflated the net present value for non-completers who attained an associate's degree and transferred to a four-year institution, but never completed a bachelor's degree.

Taking the cost figures that were calculated for the typical completer's bachelor's degree credits in Tables 7 through 10 (which were already adjusted for type of four-year transfer institution, full-time versus part-time student attendance status, and time-to-

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degree), and projecting that this third variation of the non-completer's 12 credits would be taken at some point after the 2004-2005 academic year, I derived an average per-credit cost for the bachelor's degree portion in each of the educational cost categories. When applied to the 12 bachelor's degree credits for this third variation of the non-completer case, these calculations totaled $4,024 for tuition and fees (calculated as $24,926/74 x 12), $392 for books and supplies (calculated as $2,420/74 x 12), $3,470 for the state subsidy (calculated as $21,399/74 x 12), -$1,543 for financial aid for students (calculated as -$9,517/74 x 12), $1,219 for financial aid for taxpayers (calculated as $7,518/74 x 12), $8,035 for foregone earnings (calculated as $49,552/74 x 12), and $608 for foregone taxes (calculated as $3,751/74 x 12).

When adding these costs to the associate's degree costs presented in Table 11 (since students in this third variation of the non-completer case were associate's degree recipients prior to transferring to a four-year institution), the following cost totals were calculated for Table 13: $10,149 for tuition and fees ($6,125 for the full associate's degree and $4,024 for the partial bachelor's degree credits), $1,993 for books and supplies ($1,601 for the full associate's degree and $392 for the partial bachelor's degree credits), $7,976 for the state subsidy ($4,506 for the full associate's degree and $3,470 for the partial bachelor's degree credits), -$3,412 for financial aid for students (-$1,869 for the full associate's degree and -$1,543 for the partial bachelor's degree credits), $2,696 for financial aid for taxpayers ($1,477 for the full associate's degree and $1,219 for the partial bachelor's degree credits), $36,917 for foregone earnings ($28,882 for the full associate's degree and $8,035 for the partial bachelor's degree credits), and $2,794 for

foregone taxes ($2,186 for the full associate's degree and $608 for the partial bachelor's degree credits).

Attrition Following Transfer without Associate's, Prior to Earning Bachelor's

Table 14 represented the non-completer who transferred without an earned associate's degree from a Maryland community college to a four-year public or independent institution, and did not subsequently complete a bachelor's degree. Given that there were two attrition points (both at the community college and at the four-year institution), and neither the associate's nor the bachelor's degrees were attained, I assumed that this fourth case variation would follow the non-completer path presented in Table 12 for the associate's portion of the degree (12 credits) and the non-completer path presented in Table 13 for the bachelor's portion of the degree (12 credits). Here again, it is important to acknowledge that these data were intended to represent low end estimates of educational attainment for the non-completer case.

Drawing upon the educational cost data from Tables 12 and 13, Table 14 presented the cost figures for the representative AA or AAT community college student who left the pipeline following transfer without earning an associate's degree, and prior to earning a bachelor's degree. The costs for this variation of the non-completer totaled $5,249 for tuition and fees ($1,225 for the partial associate's degree credits and $4,024 for the partial bachelor's degree credits), $712 for books and supplies ($320 for the partial associate's degree credits and $392 for the partial bachelor's degree credits), $4,371 for the state subsidy ($901 for the partial associate's degree credits and $3,470 for the partial bachelor's degree credits), -$1,917 for financial aid for students (-$374 for the partial associate's degree credits and -$1,543 for the partial bachelor's degree credits),

$1,514 for financial aid for taxpayers ($295 for the partial associate's degree credits and $1,219 for the partial bachelor's degree credits), $13,811 for foregone earnings ($5,776 for the partial associate's degree credits and $8,035 for the partial bachelor's degree credits), and $1,045 for foregone taxes ($437 for the partial associate's degree credits and $608 for the partial bachelor's degree credits).

Net Present Value for the Non-Completer Case

The third research question in this study addressed the benefits and costs that were associated with non-completion in the teacher preparation pipeline between Maryland community colleges and four-year institutions. Non-completers were defined as students who initially entered the pipeline through a Maryland community college (who may or may not have attained an associate's degree and who may or may not have subsequently transferred), and then exited this pipeline at some point prior to attaining a bachelor's degree. Four variations of the non-completer case were considered in order to capture the benefits, costs, and net present values that were associated with a range of potential student outcomes within the pipeline. Using 2004-2005 as the baseline year for initial entry into the Maryland higher education pipeline, the calculated net present values for the non-completer case were $481,346 for attrition directly following an associate's degree from a Maryland community college (Table 11); $307,950 for attrition prior to attaining an associate's degree from a Maryland community college (Table 12); $465,141 for attrition following transfer with an associate's degree from a Maryland community college, but prior to attaining a bachelor's degree from a four-year institution (Table 13); and $291,745 for attrition following transfer without an associate's degree from a

Maryland community college, but prior to attaining a bachelor's degree from a four-year institution (Table 14).

It is also important to acknowledge that there were additional categories and profiles of non-completing students in this pipeline who potentially could have been included within the scope of this third research question. Namely, attrition from the teacher education pipeline due to out-of-state transfer (in which community college students may or may not eventually attain an associate's or bachelor's degree), and attrition from the pipeline resulting from the pursuit of an alternate field outside of education (again, in which community college students may or may not eventually attain an associate's or bachelor's degree). Benefit and cost calculations for these students would conceivably follow the profiles of the optimal completer cases, typical completer cases, and non-completer cases, if one were to expand the existing definitions of these categories to include out-of-state institutions and/or degree fields outside of teacher education. These data-related issues and other potential variations on the analyses are included in the discussion of the limitations of the study in Chapter 5.

Research Question 4: Three AAT Policy Scenarios

In the previous sections in this chapter, three sets of student cases (optimal completers, typical completers, and non-completers) were developed to represent a broad range of potential pathways and outcomes among Maryland community college students in the teacher preparation transfer pipeline. The optimal completer case (Research Question 1) was the representative Maryland community college student who completed each portion of the educational pipeline in the most efficient timeframe possible and maximized the benefits stream to society after graduation. The typical completer case

(Research Question 2) was the representative Maryland community college student who followed the more typical path of community college students through bachelor's degree completion. The non-completer case (Research Question 3) was the representative Maryland community college student who exited the higher education pipeline at some point prior to bachelor's degree completion, while enrolled either at a community college or a four-year institution.

Using Gramlich's (1990) benefit-cost framework and methodologies for evaluating human investment programs, economic benefits, costs, and net present values for each of these three sets of cases were derived using available secondary data to approximate the enrollment, transfer, persistence, graduation, and employment patterns of Maryland community college students in the pipeline. For teacher education program completers (optimal completer and typical completer cases), a range of post-graduate employment outcomes were considered, including maximum returns to teaching, expected returns to teaching, alternate returns to teaching, and no returns to teaching. For the four variations of the non-completer case, post-graduate (or post-attendance) employment outcomes were assumed to be outside of the field of K-12 teaching, and the benefits premiums were commensurate with the student's highest level of educational attainment above a high school diploma.

Applying the benefit, cost, and net present value data that were calculated for the teacher preparation transfer student pipeline from the first three research questions, the fourth research question in this study considers the relative economic value of each of the following three policy scenarios for Maryland community colleges in K-12 teacher preparation: (a) historical role (Maryland community colleges retain their traditional role

in teacher preparation by providing lower-division transfer courses and programs); (b) current role (Maryland community colleges expand their traditional role by offering the AAT degree in addition to providing lower-division transfer courses and programs); and (c) hypothetical future role (Maryland community colleges offer the AAT degree as the lower-division requirement for students seeking admission into teacher preparation programs at four-year colleges and universities).

This section begins with the economic analyses and research findings for the historical role for Maryland community colleges in K-12 teacher preparation (AA only model). It proceeds with the analyses and findings for the current role for Maryland community colleges (AA plus AAT dual option model), and concludes with the analyses and findings for the hypothetical future role for Maryland community colleges (AAT only model). Consistent with the first three research questions in this study, the analyses for all three parts of this fourth research question are situated with the 2004-2005 academic year (or 2005 fiscal year, where applicable) serving as the baseline. This timeframe was chosen in order to maximize the availability of longitudinal student pipeline data from which to make various economic projections and calculations in the study. Since college graduation rates are typically calculated at four-year, five-year, and six-year intervals, the study was positioned so that a minimum of six years of historical trend data would be available for the analysis.

Historical Role of Maryland Community Colleges

The first policy scenario in this study is an historical one and corresponds with the first part of Research Question 4: What is the relative economic value of Maryland community colleges retaining their traditional role in teacher preparation by providing

lower-division transfer courses and programs? Essentially, this question examines the

historical role of Maryland community colleges in the two-year to four-year teacher

preparation transfer pipeline prior to the statewide introduction of the AAT degree during

the fall 2001 semester. Under this scenario, Maryland's COMAR regulations governed

the transfer of general education courses and degree programs among in-state institutions,

but there was no statewide articulation of lower-division degree requirements in teacher

education, nor in any other specific degree areas. Maryland community college students

could transfer to a four-year institution with or without an associate's degree in hand, and

their transcripts were subject to course-by-course review, with receiving four-year

institutions determining which credits would be accepted for transfer and which degree

requirements were remaining to be fulfilled.

Tables 15, 16, and 17 apply the benefit and cost data from the first three research

questions to actual Maryland community college student pipeline data, projecting net

present values for the historical role of Maryland community colleges, had traditional AA

teacher education transfer programs and courses been the only option in place for

students during the 2004-2005 academic year. (Table 15 provides a low-end enrollment

estimate for this scenario, Table 16 provides a mid-range enrollment estimate, and Table

17 provides a high-end enrollment estimate.) Following these three tables, the data

sources and underlying assumptions for each of the projections and calculations are

discussed in greater detail. Since the three policy scenarios under consideration in this

study specifically aim to increase the number of Maryland-prepared teachers in the two-

year to four-year teacher preparation transfer pipeline, only those net present values that

are associated with teaching outcomes in Maryland are considered (versus net present

values that are associated with pipeline participation in general). While positive net present values are also associated with pipeline participants who do not complete their college education or who do not teach (since they would earn a benefits premium over what they would have earned with a high school diploma, even after all of their educational costs are taken into account), these net present values are not considered as direct benefits to Maryland's teaching workforce. Rather, they are included in the "pipeline inefficiency index" calculations in Tables 15, 16, and 17.

Table 15

Testing the Historical Role of Maryland Community Colleges: Scenario Based on Actual FY05 Teacher Education AA Enrollments

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Projected Community College Teacher Education Pipeline Enrollees in FY05: <u>N</u>=2,716

<u>N and % of Total</u>	<u>NPV for Category</u>	<u>Attainment Level (Student Cases)</u>
1,627 (59.9%)	$307,950 (Table 12)	Attrition Prior to Associate's Degree
271 (10.0%)	$481,346 (Table 11)	Attrition Following an Associate's Degree
209 (7.7%)	$291,745 (Table 14)	Attrition Following Transfer without an Associate's Degree, Prior to Earning Bachelor's Degree
136 (5.0%)	$465,141 (Table 13)	Attrition Following Transfer with an Associate's Degree, Prior to Earning Bachelor's Degree
2,243 (82.6%)		*Sub-Total Pipeline Non-Completers*
152 (5.6%)	$908,846 (Table 8)	Typical Completers: Expected Teaching Returns
201 (7.4%)	$986,305 (Table 9)	Typical Completers: Alternate Teaching Returns
120 (4.4%)	$929,509 (Table 10)	Typical Completers: No Teaching Returns
473 (17.4%)		*Sub-Total Pipeline Completers*
2,716 (100%)	$443,098	Weighted NPV (All Attainment Levels)

Table 15 Notes:
1. Projected NPV for Teachers (<u>N</u>=152): $908,846 per individual, $138,144,592 for aggregate cohort ($908,846 x 152).
2. Projected NPV (Weighted) for All Pipeline Participants (<u>N</u>=2,716): $443,098 per individual, $1,203,454,168 for aggregate cohort ($443,098 x 2,716).
3. Economic Inefficiency Factor: 51% (average NPV loss of $465,748 for every pipeline participant who does not become a teacher in Maryland, calculated as the NPV difference between $908,846 for teaching and $443,098 for alternative attainment and employment outcomes).

Table 16
Testing the Historical Role of Maryland Community Colleges: Scenario Based on
Projected Growth Model for FY05 Teacher Education AA Enrollments

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Projected Community College Teacher Education Pipeline Enrollees in FY05: <u>N</u>=3,099

N and % of Total	NPV for Category	Attainment Level (Student Cases)
1,856 (59.9%)	$307,950 (Table 12)	Attrition Prior to Associate's Degree
310 (10.0%)	$481,346 (Table 11)	Attrition Following an Associate's Degree
239 (7.7%)	$291,745 (Table 14)	Attrition Following Transfer without an Associate's Degree, Prior to Earning Bachelor's Degree
155 (5.0%)	$465,141 (Table 13)	Attrition Following Transfer with an Associate's Degree, Prior to Earning Bachelor's Degree
2,560 (82.6%)		*Sub-Total Pipeline Non-Completers*
174 (5.6%)	$908,846 (Table 8)	Typical Completers: Expected Teaching Returns
229 (7.4%)	$986,305 (Table 9)	Typical Completers: Alternate Teaching Returns
136 (4.4%)	$929,509 (Table 10)	Typical Completers: No Teaching Returns
539 (17.4%)		*Sub-Total Pipeline Completers*
3,099 (100%)	$443,098	Weighted NPV (All Attainment Levels)

Table 16 Notes:
1. Projected NPV for Teachers (<u>N</u>=174): $908,846 per individual, $158,139,204 for aggregate cohort ($908,846 x 174).
2. Projected NPV (Weighted) for All Pipeline Participants (<u>N</u>=3,099): $443,098 per individual, $1,373,160,702 for aggregate cohort ($443,098 x 3,099).
3. Economic Inefficiency Factor: 51% (average NPV loss of $465,748 for every pipeline participant who does not become a teacher in Maryland, calculated as the NPV difference between $908,846 for teaching and $443,098 for alternative attainment and employment outcomes).

Table 17

Testing the Historical Role of Maryland Community Colleges: Scenario Based on Actual
FY05 Teacher Education AA and AAT Enrollments Combined

Projected Community College Teacher Education Pipeline Enrollees in FY05: N=4,046

N and % of Total	NPV for Category	Attainment Level (Student Cases)
2,423 (59.9%)	$307,950 (Table 12)	Attrition Prior to Associate's Degree
405 (10.0%)	$481,346 (Table 11)	Attrition Following an Associate's Degree
312 (7.7%)	$291,745 (Table 14)	Attrition Following Transfer without an Associate's Degree, Prior to Earning Bachelor's Degree
202 (5.0%)	$465,141 (Table 13)	Attrition Following Transfer with an Associate's Degree, Prior to Earning Bachelor's Degree
3,342 (82.6%)		*Sub-Total Pipeline Non-Completers*
227 (5.6%)	$908,846 (Table 8)	Typical Completers: Expected Teaching Returns
299 (7.4%)	$986,305 (Table 9)	Typical Completers: Alternate Teaching Returns
178 (4.4%)	$929,509 (Table 10)	Typical Completers: No Teaching Returns
704 (17.4%)		*Sub-Total Pipeline Completers*
4,046 (100%)	$443,098	Weighted NPV (All Attainment Levels)

Table 17 Notes:
1. Projected NPV for Teachers (N=227): $908,846 per individual, $206,308,042 for
aggregate cohort ($908,846 x 227).
2. Projected NPV (Weighted) for All Pipeline Participants (N=4,046): $443,098 per
individual, $1,792,774,508 for aggregate cohort ($443,098 x 4,046).
3. Economic Inefficiency Factor: 51% (average NPV loss of $465,748 for every pipeline
participant who does not become a teacher in Maryland, calculated as the NPV difference
between $908,846 for teaching and $443,098 for alternative attainment and employment
outcomes).

The projected baseline for the student pipeline in Table 15 included only those 2,716 students who were actually enrolled in an AA teacher education transfer program in a Maryland community college in FY05, and excluded the 1,330 students who were enrolled in an AAT program (USM, 2006). This projected enrollment number was smaller than the average annual enrollments in AA teacher education transfer programs prior to the introduction of the AAT degree, suggesting that there have been shifts in community college student enrollments from the AA to the AAT over time. Between FY97 and FY01, for example, AA teacher education transfer programs enrolled an average of 3,025 students statewide each year, including 2,843 students in the year prior to the introduction of the first AAT degrees in elementary education in fall 2001 (USM, 2006). Overall, the teacher education population at Maryland community colleges has grown since the introduction of the AAT, with 4,046 students enrolled in AA and AAT programs (combined) statewide in FY05, while the relative proportion of AA enrollments has steadily declined. Thus, the student pipeline figures that were presented in Table 15 should be considered as low-end projections for student enrollments under the historical role for Maryland community colleges in 2004-2005, as I assumed that none of the AAT students would be enrolled in a traditional AA teacher education transfer degree program, if the AAT had not been available at that time.

The projected baseline for the student pipeline in Table 16 assumed that FY05 enrollments in AA teacher education transfer programs would have been commensurate with general enrollment growth trends at Maryland community colleges, if the AAT had not been in place at that time. In FY01, prior to the introduction of the AAT, there were 2,843 community college students enrolled in traditional AA teacher education transfer

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programs statewide (USM, 2006). Between FY01 and FY05, student headcount

enrollments at Maryland community colleges increased by 9% (109,411 students in FY01

and 119,142 students in FY05) (MHEC, 2009d). Assuming that teacher education

program enrollments would have followed these general community college growth

trends, increasing the FY01 baseline figure of 2,843 teacher education students by 9%

yielded a projection of 3,099 students in FY05. (As will be discussed in later sections in

this chapter, however, enrollment growth in teacher education programs has outpaced

community college enrollment growth in general since the introduction of the AAT.)

Thus, the student pipeline figures that were presented in Table 16 should be considered as

mid-range projections for student enrollments under the historical role for Maryland

community colleges in 2004-2005.

The projected baseline for the student pipeline in Table 17 included all 4,046

Maryland community college students statewide in FY05 who were either enrolled in a

traditional AA teacher education transfer program (2,716 students) or an AAT program

(1,330 students) (USM, 2006). These projections assumed that all of these students

would have been enrolled in a traditional AA teacher education transfer program if the

AAT had not been available, and that the rate of growth in community college teacher

education programs would have happened regardless of the introduction of the AAT

degree. Thus, the student pipeline figures that were presented in Table 17 should be

considered as high-end projections for student enrollments under the historical role for

Maryland community colleges in 2004-2005.

For each of the three projected pipeline scenarios for the historical role of

Maryland community colleges in teacher preparation, I placed students into one of seven

attainment categories, based on actual pipeline data that were available regarding the progression of community college students who were enrolled during the 2004-2005 academic year. The first four categories in Tables 15, 16, and 17 were considered to be pipeline non-completers (and were originally introduced in Research Question 3), while the remaining three categories were considered to be pipeline completers (and were originally introduced in Research Question 2). For the community college portions of the projected pipeline, data were drawn from an MHEC (2010a) cohort-based study of new full-time students who entered Maryland community colleges in FY05. Student retention, transfer, and graduation data showed that after four years of community college enrollment, 12.9% of the students were still enrolled, 8.9% had graduated but had not transferred, 26.0% had transferred to a Maryland four-year public or independent institution, and the remaining 52.2% had not been retained (MHEC, 2010a). (Parallel data were unavailable for transfer students and part-time students enrolled in Maryland community colleges, so the full-time student cohort data were used to approximate the progression of the entire pipeline.)

For the four-year institutional portions of the projected pipeline, data were drawn from an MHEC (2011) cohort study of students who transferred from Maryland community colleges to Maryland four-year public institutions in FY05, which showed that 54.8% of these students (full-time and part-time combined) had earned a bachelor's degree within five years of transferring, while the remaining 45.2% had not. Data were also used to project the likelihood of a Maryland community college student transferring to a four-year institution with an earned associate's degree versus without an earned associate's degree (estimated at 40% versus 60%, respectively) (USM, 2010), and the

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likelihood of a Maryland community college student in a teacher education transfer

program continuing to pursue an education major after transferring to a four-year

institution (10 year average prior to the introduction of the AAT was 57.4%) (MHEC,

2004b). For the post-graduate portions of the projected pipeline, data were drawn from

several sources that were originally introduced in Research Questions 1, 2, and 3,

including the likelihood of pipeline graduates going into K-12 teaching (Jacob France

Institute, 2007; MSDE, 2009) and working in Maryland over time (GWIB, 2008; MHEC,

2009b).

Drawing on the data sources above (Jacob France Institute, 2007; GWIB, 2008;

MHEC, 2004b; MHEC, 2009b; MHEC, 2010a; MHEC, 2011; MSDE, 2009; USM, 2010)

for the pipeline projections in Tables 15, 16, and 17, I calculated the following

projections by placing students into the appropriate attainment categories in the analysis,

beginning with the four categories for non-completers in the pipeline, followed by the

three categories for completers in the pipeline:

Attrition prior to an associate's degree (59.9%):

(52.2% + 7.7%) = 59.9%

This category included all non-retained students (52.2%) during or after four

years of community college enrollment, assuming that an additional 7.7% of the

students who were still enrolled in the community college would eventually join

this category. 7.7% was the calculated proportional representation of future non-

retained students who remained in the community college pipeline after four

years, in comparison to those remaining students who were projected to attain an

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associate's degree but not transfer in the future, and those remaining students

who were projected to transfer in the future.

Attrition following an associate's degree (10.0%):

(8.9% + 1.1%) = 10.0%

This category included all retained students who had graduated with an

associate's degree but not transferred (8.9%) during or after four years of

community college enrollment, assuming that an additional 1.1% of the students

who were still enrolled in the community college would eventually join this

category. 1.1% was the calculated proportional representation of future non-

transfer associate's degree holders who remained in the community college

pipeline after four years, in comparison to those remaining students who were

projected to leave the pipeline altogether, and those remaining students who were

projected to transfer in the future.

Attrition following transfer without an associate's degree, but prior to earning a

bachelor's degree (7.7%):

((26.0% + 2.3%) x 60.0% x 45.2%) = 7.7%

The baseline calculations for this category included all retained students who had

transferred (26.0%) during or after four years of community college enrollment,

assuming that an additional 2.3% of the students who were still enrolled in the

community college would eventually join this category. 2.3% was the calculated

proportional representation of future non- associate's degree holder transfer

students who remained in the community college pipeline after four years, in

comparison to those remaining students who were projected to leave the pipeline

altogether, those remaining students who were projected to earn an associate's degree but not transfer, and those remaining students who were projected to transfer with an associate's degree. The calculations assumed that 60.0% of the students who transferred during or after four years of community college enrollment did so without earning an associate's degree, and that 45.2% of these students would not end up graduating with a bachelor's degree within five years of transferring.

Attrition following transfer with an associate's degree, but prior to earning a bachelor's degree (5.0%):

((26.0% + 1.6%) x 40.0% x 45.2%) = 5.0%

The baseline calculations for this category included all retained students who had transferred (26.0%) during or after four years of community college enrollment, assuming that an additional 1.6% of the students who were still enrolled in the community college would eventually join this category. 1.6% was the calculated proportional representation of future associate's degree holder transfer students who remained in the community college pipeline after four years, in comparison to those remaining students who were projected to leave the pipeline altogether, those remaining students who were projected to earn an associate's degree but not transfer, and those remaining students who were projected to transfer without an associate's degree. The calculations assumed that 40.0% of the students who transferred during or after four years of community college enrollment did so with an earned associate's degree, and that 45.2% of these students would not end up graduating with a bachelor's degree within five years of transferring.

Typical completers with returns to teaching (5.6%):

(17.4% x 57.4% x 75.0% x 75.0%) = 5.6%

The baseline calculations for this category included all projected pipeline completers at the bachelor's degree level (17.4%). These calculations assumed that 57.4% of the students would remain in teacher education versus changing to another major at the bachelor's degree level (based on 10-year calculated statewide averages), that 75.0% would remain in the state immediately upon graduation, with the potential for out-of-state migration over time, and that 75.0% would enter the Maryland K-12 teaching workforce for some period of time after graduation.

Typical completers with alternate returns to teaching (7.4%):

((17.4% x 42.6%) + (17.4% x 57.4% x 25.0%)) x 75.0%) = 7.4%

The baseline calculations for this category included all projected pipeline completers at the bachelor's degree level (17.4%). These calculations assumed that 42.6% of the students would change to another major at the bachelor's degree level versus remain in teacher education (based on 10-year calculated statewide averages), and that none of these students would pursue teaching. Among the 57.4% of pipeline completers who were projected to remain in teaching through completion of the bachelor's degree, 25.0% would enter an alternate career field outside of the Maryland K-12 teaching workforce after graduation. 75.0% of both sub-categories of completers would remain in the state immediately upon graduation, with the potential for out-of-state migration over time.

Typical completers with no returns to teaching (4.4%):

(17.4% x 25.0%) = 4.4%

The baseline calculations for this category included all projected pipeline

completers at the bachelor's degree level (17.4%). These calculations assumed

that 25.0% of the students would leave the state immediately upon graduation,

generating no future economic returns to Maryland. These students may or may

not remain in teacher education as major at the bachelor's degree level, and may

or not may entering teaching upon graduation.

When multiplying the projected distribution of students in the four non-completer

categories and the three completer categories in Tables 15, 16, and 17 by the net present

values for each category (the amounts of which were derived through the analyses for the

first three research questions in this chapter), the weighted net present value per pipeline

participant was $443,098, or (($307,950 x .599) + ($481,346 x .100) + ($291,745 x .077)

+ ($465,141 x .050) + ($908,846 x .056) + ($986,305 x .074) + ($929,509 x .044)).

While the weighted net present values per individual pipeline participant were identical

across Tables 15, 16, and 17, since all three sets of students were assumed to exhibit

typical progression (or non-progression) through the pipeline according to historical

Maryland community college student transfer patterns, the aggregate net present values

differed according to the number of pipeline enrollees that were projected for each

scenario. These aggregate figures were calculated in the table notes.

For the first scenario in Table 15 (assuming actual AA teacher education transfer

program enrollments in FY05), the aggregate net present value for the 152 Maryland

teachers (i.e., those graduates with expected teaching returns) who were projected to be

produced through the pipeline was $138,144,592. For the second scenario in Table 16

(assuming that AA teacher education transfer program enrollment growth in FY05 would

have been commensurate with general community college student enrollment growth,

without the introduction of the AAT), the net present value for the 174 Maryland teachers

who were projected to be produced through the pipeline was $158,139,204. For the third

scenario in Table 17 (assuming that all AAT enrollments in FY05 would have been AA

teacher education transfer program enrollments anyway, without the introduction of the

AAT), the net present value for the 227 Maryland teachers who were projected to be

produced through the pipeline was $206,308,042.

When taking the difference between the average net present value for each teacher

who was produced through the pipeline ($908,846 per individual, with a low estimate of

152 teachers, a middle estimate of 174 teachers, and a high estimate of 227 teachers),

versus the weighted net present value for all pipeline participants ($443,098 per

individual, with a low estimate of 2,716 participants, a middle estimate of 3,099

participants, and a high estimate of 4,046 participants), there was a 51% loss in net

present value per participant (referred to as the "economic inefficiency factor" in the

table notes). In other words, under the historical role for Maryland community colleges,

there was an average net present value loss of $465,748 for every pipeline participant

who did not become a Maryland teacher (which was calculated as the difference between

$908,846 for bachelor's degree attainment and teaching, and $443,098 for all combined

categories of attainment and employment outcomes).

Current Role of Maryland Community Colleges

The second policy scenario in this study is a current one and corresponds with the second part of Research Question 4: What is the relative economic value of Maryland community colleges expanding their traditional role by offering the AAT degree in addition to providing lower-division transfer courses and programs? Essentially, this question examines the current role of Maryland community colleges in the two-year to four-year teacher preparation transfer pipeline since the initial state approval of the first set of AAT degrees (in elementary education) in 2001. Since that time, additional AAT degrees have been approved and implemented in early childhood education, special education (in combination with elementary education), and in the secondary certification areas of chemistry, mathematics, physics, Spanish, and English. All 16 Maryland community colleges currently offer at least one AAT program, and most offer AAT degrees in multiple certification areas. In addition, the majority of Maryland community colleges have maintained their traditional AA teacher education transfer programs as an option for students, with the exception of two institutions that have transitioned exclusively to the AAT and are no longer enrolling students in or graduating students from their traditional AA teacher education transfer programs.

Since the introduction of the AAT in fall 2001, there has been substantial growth both in the annual number of associate's degrees granted through Maryland community college teacher preparation programs, as well as in annual student headcount enrollments in these programs. Between FY01 and FY05, the production of teacher education associate's degrees in Maryland community colleges grew by 55%, from 223 degrees (all AAs) granted statewide in FY01, to 346 degrees (118 AATs and 228 AAs) granted

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statewide in FY05 (USM, 2006). Over this same five-year time period (FY01 to FY05), the comparable overall associate's degree growth rate at Maryland community colleges was 31%, or 24 percentage points lower than the associate's degree growth rate in teacher education programs (AAT and AA combined) (MHEC, 2008d). Also between FY01 and FY05, teacher education student headcount enrollments in Maryland community colleges grew by 42%, from 2,843 students statewide in FY01 (all enrolled in traditional AA teacher education transfer programs), to 4,046 students statewide in FY05 (1,330 students enrolled in AAT programs and 2,716 students enrolled in traditional AA teacher education transfer programs) (USM, 2006). Over this same five-year time period (FY01 to FY05), the comparable overall student headcount enrollment growth rate at Maryland community colleges was 9%, or 33 percentage points lower than the enrollment growth rate in teacher education programs (AAT and AA combined) (MHEC, 2009d).

These data indicate that since the introduction of the AAT, associate's degree production and student enrollment rates have increased more rapidly in teacher education transfer programs than in Maryland community colleges overall. It is a plausible explanation that these trends could be attributed in part to the availability of the new AAT degrees, but to what extent is uncertain. Since the introduction of the AAT, the annual number of students enrolled in traditional AA teacher education transfer programs has steadily decreased statewide, as has the annual number of associate's degrees granted from these programs, although the AA still remains as a viable pathway for Maryland community college students in teacher preparation. The AAT exceeded the education AA in the number of degrees granted for the first time in FY07, with 213 AAT graduates that year, in comparison to 168 education AA graduates (MHEC, 2010c). When looking

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at annual degree production as a percentage of enrolled students across each program, however, the calculated yields for the AAT and AA are virtually identical. In FY05, for example, the AAT granted 118 degrees per 1,330 enrolled students (8.9%) and the education AA granted 228 degrees per 2,716 enrolled students (8.4%).

In terms of student transfer patterns since the introduction of the AAT, when examining the data for Maryland community college students in teacher education programs who transferred to USM four-year public institutions, there was a 4% decrease between FY01 and FY05—from 615 transfer students in FY01 (AA pathway only), to 589 transfer students in FY05 (both AAT and AA pathways) (USM, 2006, 2010). In the general community college transfer student population in Maryland, there was a 16% increase in transfer activity during this same time period—6,959 transfer students from Maryland community colleges to USM four-year public institutions in FY01, in comparison to 8,048 transfer students in FY05 (USM, 2005, 2010). A 2006 analysis of teacher education transfer patterns to USM institutions noted that transfer rates from Maryland community college teacher education programs had not kept pace with growth patterns in student enrollments and degree production in these programs, and that retention and graduation rates among community college education transfers to four-year institutions had remained unchanged since the introduction of the AAT (USM, 2006). In addition, transfer yields against overall enrollments and degrees in community college teacher education programs had slightly declined since the introduction of the AAT (USM, 2006). In FY01, the annual community college student transfer yield was 19% against all community college teacher education program enrollees, while in FY05, it was 15%. In FY01, the annual community college student transfer yield was 244% against all

teacher education associate's degree graduates, while in FY05, it was 170%. Given the increases in teacher education enrollments and teacher education associate's degree production in Maryland community colleges over this time period, the report suggested that transfer patterns may have been shifting toward students remaining enrolled in community colleges longer and completing associate's degrees prior to transferring to four-year institutions (USM, 2006).

In terms of developments at the bachelor's degree end of Maryland's two-year to four-year teacher education transfer pipeline (i.e., the number of newly prepared K-12 teacher candidates who graduate from Maryland four-year public and independent colleges and universities), annual teacher production has remained relatively constant since the AAT was first introduced. In FY01, there were 2,332 newly prepared teacher candidates from Maryland public and independent four-year institutions, as compared to 2,349 newly prepared teacher candidates in FY09 (MSDE, 2010). (These data include all teacher certification areas and all approved higher education based teacher certification pathways in Maryland, including bachelor's degrees, post-bachelor's certificates, and master's degrees.) Over this same time period (FY01 to FY09), the average annual number of newly prepared teacher candidates from all Maryland higher education institutions combined was 2,453 teachers (MSDE, 2010).

In terms of developments at the workforce end of Maryland's two-year to four-year teacher education transfer pipeline, Maryland public schools hired 1,896 newly prepared teacher candidates from Maryland colleges and universities in FY01 (25% of the entire pool of new teacher hires that year), as compared to 985 newly prepared teacher candidates from Maryland colleges and universities in FY09 (19% of the entire

pool of new teacher hires that year) (MSDE, 2010). Over this same time period (FY01 to FY09), the average annual number of newly prepared Maryland teacher candidates who were hired into Maryland public schools was 1,469 (MSDE, 2010). In terms of yield, in FY01 there were 2,332 teacher candidates produced in Maryland, 1,896 of whom were hired by Maryland public schools (a yield of 81%), whereas in FY09, there were 2,349 teacher candidates produced in Maryland, 985 of whom were hired by Maryland public schools (a yield of 42%). It is important to note here that there were overall decreases in the number of newly hired teachers in Maryland public schools during this time period (7,649 new teachers in FY01 versus 5,241 new teachers in FY09, a decrease of 31%) (MSDE, 2010), likely due to broader economic factors including lower rates of teacher retirement and attrition, district budget cuts, and other retrenchment efforts in the state's K-12 teaching workforce. These data suggest that there could be individual and societal costs associated with the overproduction of teachers in the pipeline, particularly in subject areas such as elementary education, where there have traditionally been teacher surpluses. This issue will be explored further in the discussion of the study's findings in Chapter 5.

Taken together, these data suggest that since the introduction of the AAT, the early stages of the teacher education pipeline have grown in Maryland community colleges in terms of student enrollments and associate's degree production, while transfer rates to four-year institutions and bachelor's degree production rates have not noticeably increased in education. In addition, the number of teacher candidates graduating from Maryland public and independent four-year institutions has remained relatively constant since the introduction of the AAT, while the number and proportion of newly prepared

Maryland teacher candidates going into teaching in Maryland public schools has actually declined.

Given these general observations, one of the challenges in conducting an analysis of this current policy scenario is that there has been no comprehensive study to date that has followed cohorts of AAT and AA teacher education transfer program students through the entire educational pipeline—from initial enrollment at a Maryland community college, through associate's degree completion and/or transfer, through enrollment at a public or independent four-year institution, through bachelor's degree completion, and into Maryland's K-12 teaching workforce (or into other post-graduate employment alternatives). In published reports from MHEC and USM on community college transfer students in Maryland, AAT and AA students are reported together in a single category ("teacher education transfers"), as are transfer students with and without earned associate's degrees. While data are available from which to draw more general conclusions regarding inputs and outputs as they relate to Maryland's two-year to four-year teacher preparation transfer pipeline, it is difficult to gain a more nuanced understanding of the efficiency and effectiveness of various program alternatives within this pipeline (i.e., enrollment in an AAT program versus a traditional AA program, transferring with an associate's degree versus transferring without an associate's degree) without tracking student progression more systematically at the unit-record or student transcript level. Challenges and potential solutions that are related to the lack of longitudinal student pipeline data, and the resulting impact on the findings in this study, are discussed in greater detail in Chapter 5.

While not a comprehensive statewide two-year to four-year student pipeline study, the USM Office of Institutional Research granted me access to a scrubbed unit-record dataset of elementary education bachelor's degree recipients from USM four-year public institutions between FY01 and FY08, matched against Transfer Student System (TSS) data, in order to calculate how many of these bachelor's degree completers originated from Maryland community colleges. Elementary education majors were selected as the sub-population for this analysis since they comprise the vast majority of AAT degrees currently granted (over 90%) (MHEC 2010c), and since it can be difficult to systematically identify secondary education degree graduates in state-level datasets (given the requirement of a content major which may or may not be accompanied by a second major in education). I chose FY01 to FY08 as the timeframe for this analysis since it included the year prior to the introduction of the first AAT degrees in elementary education (FY01), and it also included the four core years that were the focus of the pipeline analyses in the study's first three research questions (using FY05 as the baseline year). While the TSS data did not designate degree status among transfer students (i.e., transferred with or without an earned associate's degree) or degree type (i.e., AAT degree, traditional AA teacher education transfer degree, or AA in another degree field), consistent with the data limitations previously described, the analyses did provide insight into general attainment and completion trends since the introduction of the AAT. These data are summarized in Table 18. Following Table 18, I apply the benefit, cost, and net present value data from earlier in the chapter to the current policy scenario for Maryland community colleges.

Table 18
Community College Transfers as a Percentage of Bachelor's Degree Recipients in Elementary Education Since the AAT

| Graduation Year | Number of Graduates | Origins of USM Bachelor's Degree Recipients in Elementary Education | | | | | | | Time to Degree After Transfer for Maryland Community College Students | | | |
		Native First-Time Students		Maryland Community College Transfer Students		Transfer Students from Other Institutions		2 years	3 years	4 years	5+ years
FY01	590	326	55%	173	29%	91	15%	18%	52%	20%	10%
FY02	575	339	59%	159	28%	77	13%	19%	57%	17%	8%
FY03	582	355	61%	162	28%	65	11%	21%	45%	21%	13%
FY04	595	390	66%	152	26%	53	9%	30%	41%	14%	14%
FY05	557	386	69%	125	22%	46	8%	22%	51%	17%	10%
FY06	583	386	66%	151	26%	46	8%	32%	34%	17%	17%
FY07	525	384	73%	97	18%	44	8%	14%	36%	31%	19%
FY08	442	343	78%	85	19%	14	3%	51%	5%	26%	19%

Data Source: Degree Information System (DIS) and Transfer Student System (TSS) Matched Records Dataset, USM Office of Institutional Research

While the calculations for the historical role for Maryland community colleges in Tables 15, 16, and 17 began with a cohort of students and then moved forward to track their anticipated progression through the statewide two-year to four-year teacher preparation transfer pipeline, Table 18 began with a sub-population of program completers (elementary education bachelor's degree recipients at USM institutions) and tracked them backward through the two-year to four-year transfer pipeline. As shown in Table 18, while 29% of USM bachelor's degree recipients in elementary education in FY01 had originally transferred from a Maryland community college, by FY08, this proportion had decreased to 19%. In general, the data showed a 25% decrease in the number of elementary education bachelor's degree recipients between FY01 and FY08 (from 590 graduates to 442 graduates), and a 51% decrease in the number of bachelor's degree recipients who were originally transfer students from Maryland community colleges (from 173 graduates to 85 graduates). (There was an even greater decrease in the number of bachelor's degree recipients who were originally transfer students from other types of institutions—from 91 graduates in FY01 to 14 graduates in FY08, a decrease of 85%.) The time-to-degree data for Maryland community college transfers followed a relatively uniform pattern through FY07, with the largest percentages of students graduating at the three-year mark following transfer, until FY08, when a higher percentage (51%) graduated at the two-year mark following transfer. While these data were not representative of all bachelor's degree level teacher certification areas and all higher education institutions statewide, they did confirm USM's (2006) previous findings around declining community college transfer yields relative to student enrollments and degree production in teacher education.

While more Maryland community college students entered the teacher preparation pipeline and attained associate's degrees in education during the timeframe that was considered for this benefit-cost study, these developments had not yet translated into higher student transfer rates, bachelor's degree attainment rates, or K-12 teacher production rates. In terms of increased attainment in general since the introduction of the AAT, the net present value that was associated with associate's degree recipients ($481,346, drawing on data from Research Question 3), regardless of whether they eventually transferred, was $173,396 higher than for students who left college prior to attaining an associate's degree (Table 12), and $189,601 higher than for students who transferred to a four-year institution without an associate's degree and did not subsequently complete a bachelor's degree (Table 14). While earning an associate's degree without a bachelor's degree does not directly benefit the teaching profession in terms of producing more certified teachers, it does return a higher net present value both to individuals and to society than does college attendance alone without an earned associate's degree, even after all educational costs are taken into account.

If the introduction of the AAT has not influenced the progression of Maryland community college students progression beyond the associate's degree level, then the net present value data that were presented earlier in this chapter in Table 17 would provide an appropriate representation for the current role of Maryland community colleges, given the benefit-cost framework and methods in this study. Table 17 included future attainment projections for the entire population of Maryland community college AAT and AA enrollees (4,046 students) in FY05, with a weighted net present value of

$443,098 per pipeline participant, a weighted net present value of $908,846 per pipeline teacher, and the projected number of pipeline teachers employed in Maryland at 227.

The data that were presented in Table 18, while not providing a complete picture of all education bachelor's degree recipients statewide, did suggest downward shifts in the proportion of Maryland-prepared teachers with origins in Maryland community colleges since the introduction of the AAT in 2001. Given recent growth trends in enrollments and degrees in teacher education programs in Maryland community colleges, it is possible that students are now taking longer and waiting to complete the associate's degree prior to transferring (given the fully articulated nature of the AAT), which could depress the bachelor's degree attainment numbers for a certain time period, until more Maryland community college students move through the four-year portion of the pipeline. It is also possible that these enrollment and attainment patterns could differ between AAT and AA students (e.g., retention, transfer rates, time-to-degree), given the structure of each degree program, which would require additional analyses of the pipeline data at the student transcript level. Or, it is possible that the AAT's more intensive focus on teaching in lower division courses has caused more community college students to select out of an education major at an earlier point in time (i.e., prior to pursuing a bachelor's degree) than they would have traditionally. Given the state of the economy and the shrinking availability of open K-12 teaching positions in Maryland, it is also possible that more students are initially entering teaching programs in Maryland community colleges, but then choosing to pursue other majors at the bachelor's degree level. Additional data in these areas could help to further refine the scope of the analyses in this study, and are discussed in Chapter 5 as areas for further research.

Hypothetical Future Role of Maryland Community Colleges

The third policy alternative under consideration in this study is a hypothetical future scenario that corresponds with the third part of Research Question 4: What is the relative economic value of Maryland offering the AAT degree as the lower-division requirement for community college students seeking admission into teacher preparation programs at four-year colleges and universities? In other words, what if community college students were actually required to complete the AAT degree in order to gain admission into a four-year college or university teacher preparation program (versus completing an alternate associate's degree program or transferring prior to the completion of an associate's degree)? While this third policy scenario is not currently under consideration in Maryland, it does raise several issues that warrant further exploration from the perspective of how these developments would impact the two-year to four-year teacher preparation pipeline, and ultimately, K-12 teacher production. Namely, in terms of pipeline progression, this policy would place new restrictions on community college students by necessitating the receipt of an associate's degree prior to transfer. While many of the state's teacher preparation programs at the bachelor's degree level are structured as limited enrollment programs (meaning that there are program-specific entrance requirements such as a minimum GPA threshold and prerequisite coursework, in addition to institutional admission requirements), no four-year institutions in Maryland currently require the completion of an associate's degree as a condition for admission. As has been discussed previously, the majority of Maryland community college students who transfer to a four-year institution currently do so prior to attaining an associate's degree (USM, 2009).

Moreover, under this hypothetical future policy scenario, Maryland community college students would have to meet the added requirements of a 2.75 cumulative GPA and a passing score on the national Praxis I teacher examination (pre-professional skills test), or else the AAT would not be granted, even if all other degree requirements were completed at the community college. Among Maryland teacher education community college transfer students to USM four-year public institutions between FY01 and FY05, the average cumulative GPA at the time of transfer was 2.90 (USM, 2006). (Presumably, some percentage of these students would have transferred with a cumulative GPA under 2.75.) For Maryland community college students who are unable to meet the minimum GPA and Praxis I graduation requirements for the AAT, the traditional AA teacher education transfer program, as well as AA programs in other academic disciplines, are still currently options (although they would no longer remain options under the hypothetical future scenario). Under current state COMAR regulations, Maryland community college students who have completed an associate's degree or at least 56 semester hours of credit cannot be denied direct transfer to a Maryland four-year public institution, provided they have a minimum cumulative GPA of 2.0, although they are not guaranteed admission into limited enrollment majors and programs such as teacher education at the four-year institution (MHEC, 2010b).

Drawing upon the benefit, cost, and net present value data that were presented earlier in this chapter, there are several factors that could potentially be considered in the analysis of this third hypothetical future policy scenario. One such factor pertains to the marginal net present value differences between teacher candidates in Maryland's two-year to four-year teacher preparation transfer pipeline who complete an associate's

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degree versus those who do not. The benefit and cost calculations for the first two research questions in this study, which were presented earlier in this chapter in Tables 3 through 10, provided net present value calculations for program completers who were projected to optimize the pipeline (with an associate's degree) versus transfer (with or without an associate's degree). Among Maryland community college students with an earned associate's degree who eventually transferred with all lower-division degree requirements complete (as the AAT was designed), the net present value for the educational investment was higher than for the typical completer, due to the lower costs that were associated with the longer period of enrollment at the community college, and the elimination of redundant course-taking upon transfer.

Moving teacher candidates toward the optimal degree completion pathway (Research Question 1), which included attainment of both the associate's and bachelor's degrees, yielded a net present value of $931,016 (high-end value based on full-time college attendance), versus $908,846 for the typical completer (who may or may not have earned an associate's degree). When considering the potential net present value increase of $22,170 per teacher multiplied across the cohort of 227 Maryland teachers that was projected from the pipeline earlier in this chapter (Table 17), the increase in the net present value for the entire pool of teachers would be $5,032,590 (i.e., the difference in the aggregate net present value of $211,340,632 for optimal completers and $206,308,042 for typical completers). So, theoretically, if all of the teacher candidates in this pipeline had moved toward associate's degree completion prior to transferring to a four-year institution (and other factors had remained constant, including enrollment,

transfer, and graduation rates), higher net present values would have resulted from their educational investment.

A similar set of analyses pertain to marginal net present value differences between Maryland community college students who complete an associate's degree versus those who do not, regardless of whether they eventually transfer to a four-year institution to pursue a teacher education degree. In Research Question 3 earlier in this chapter (which calculated net present values for community college students who were not projected to complete the four-year institutional portion of the pipeline), the net present value for an associate's degree holder was $189,601 higher than for a comparable student in the pipeline who began an associate's degree but did not complete it prior to transfer ($481,346 versus $291,745), and $173,396 higher than for a comparable student in the pipeline who began an associate's degree but neither completed it nor transferred ($481,346 versus $307,950). From an economic perspective, the net present value of having the associate's degree in hand—regardless of whether the student eventually transferred or earned a bachelor's degree—made the effort a good investment for individual students since their earnings were projected to be higher, on average, than they would have been without having earned the associate's degree. However, from the perspective of increasing the number of Maryland prepared certified teachers, the benefits that are associated with non-completion do not directly support this policy development, since community college students cannot become certified K-12 teachers with an associate's degree alone.

As previously discussed, student enrollments and associate's degree production in teacher education transfer programs have increased more rapidly than overall growth

trends at Maryland community colleges since the introduction of the AAT. It is plausible

to assume that the AAT has had some impact on these developments in Maryland

community colleges, but to what extent is uncertain. There is some evidence that teacher

education transfer student behavior has been changing since the introduction of the

AAT—namely, that students may be staying at the community college longer before

transferring (USM, 2006). Therefore, when considering this third hypothetical policy

scenario, it is also important to consider the impact that an "all or nothing" AAT policy

could have on the actual numbers of teacher education students transferring from

Maryland community colleges to four-year colleges and universities.

Historical two-year to four-year student transfer trend data in Maryland show that

in all academic programs combined, approximately 60% of community college students

who transfer do so prior to attaining an associate's degree (USM, 2009). Between FY01

(the year that the AAT in elementary education was first introduced) and FY05, a total of

1,356 Maryland community college students graduated with an AAT or AA degree in

education, while a total of 3,060 Maryland community college education majors

transferred to a USM four-year public institution (USM, 2006). Assuming on the high

end that all 1,356 of these AAT or AA degree recipients transferred over the five-year

period, and 86% (1,166 students) did so to USM four-year public institutions in

proportion with prevailing transfer trends (MHEC, 2004a), the difference would yield

1,894 teacher education transfer students who had transferred without an associate's

degree, or 62% of the total transfer pool.

Examining FY05 data only, four years after the initial implementation of the

state's first AAT degrees, a total of 346 Maryland community college students graduated

with an AAT or AA degree in education, while a total of 589 Maryland community

college education majors transferred to a USM four-year public institution (USM, 2006).

Using the same assumptions as above, assuming on the high end that all 346 of these

AAT or AA degree recipients transferred over the five-year period, and 86% (298

students) did so to USM four-year public institutions in proportion with prevailing

transfer trends (MHEC, 2004a), the difference would yield 291 teacher education transfer

students who had transferred without an associate's degree, or 49% of the transfer pool.

These trends illustrate that while an earned associate's degree has not been the exclusive

gateway for teacher preparation transfer among the majority of Maryland community

college students, attainment at the associate's degree level does appear to be increasing

among members of this population.

Applying the potential loss rate of 49% to the data that were presented in Table 17

for the 4,046 Maryland community college students who were enrolled in teacher

education transfer programs in FY05, the AAT-only policy could translate into the loss of

approximately 111 teachers from the pipeline (or 49% of the 227 teachers who were

projected to graduate and teach in Maryland public schools). In addition, the potential

net present value reduction could be up to $623,066 per lost teacher, calculated as the net

present value difference between $931,016 (community college students who optimized

the pipeline and taught in Maryland for a period of time) and $307,950 (community

college students who left the pipeline prior to attaining an associate's degree). While

some percentage of Maryland community college students in the pipeline would likely

choose to convert to the AAT completion pathway if this were the only option available

to them, it is unclear how many students would ultimately make this choice, and under what circumstances.

While this third AAT policy scenario is only a hypothetical one for Maryland, from the available student pipeline data it appears that the implementation of this policy would have positive economic outcomes for individual students who choose to participate (as well as positive outcomes for society), as evidenced by the increased net present values that were associated with optimal completion versus typical completion within the educational pipeline. In terms of the transfer process, community college students who earn an AAT degree should be better prepared to enter a teacher education major at a four-year institution with all of their lower division coursework and requirements complete. In addition, these students should have an academic experience during their first two (equivalent) years of college that would more closely parallel that of native students in teacher education bachelor's degree programs at four-year institutions. At the same time, however, it appears that an AAT-only policy could have negative outcomes for the size and viability of the two-year to four-year teacher preparation transfer pipeline, as well as negative outcomes for the goal of graduating more K-12 teachers, since historically, the majority of Maryland community college students have transferred prior to attaining an associate's degree, and they would no longer be eligible for admission into a teacher preparation program at a four-year institution.

Summary

Chapter 4 presented the results and findings from the study's four research questions pertaining to the role of Maryland community colleges in K-12 teacher preparation. Economic benefits and costs were calculated for three representative

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categories of community college students in the state's educational pipeline: optimal

completer cases, typical completer cases, and non-completer cases. Using benefit-cost

analysis, net present values were derived for each case variation. These data were then

applied to the analysis of three policy scenarios for Maryland community colleges in

teacher preparation (historical, current, and future), had each been in place during the

2004-2005 academic year, in order to examine the relative economic value of each

alternative. A discussion of the findings, conclusions, and broader implications of the

study, including limitations and directions for future research, are presented in Chapter 5.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

In Chapter 4, findings were presented for each of the study's research questions pertaining to optimal, typical, and non-completion pathways in the State of Maryland's teacher preparation transfer pipeline, as well as historical, current, and hypothetical future roles for Maryland community colleges in teacher preparation. Using the framework of benefit-cost analysis, the net present values for each of these cases and scenarios were compared in economic terms. Chapter 5 begins with a discussion of the results of the study and general observations and conclusions that can be drawn based on these findings. It continues with an analysis of major implications of the study, both in terms of theory and practice. Implications for key stakeholder groups that are affected by these policy decisions are also examined. The chapter concludes with a summary of limitations and recommendations for future research on this topic.

Discussion of the Findings

Chapter 4 presented the results of the benefit-cost analysis for each of three alternative policy scenarios for the role of Maryland community colleges in teacher preparation. First, economic benefits, costs, and net present values were calculated for three representative categories of community college students in the state's teacher education pipeline, using the 2004-2005 academic year as the baseline for the analysis. These analyses addressed the study's first three research questions, examining optimal completion, typical completion, and non-completion in the Maryland student transfer pipeline. The benefit and cost data were then used to analyze the relative economic value

of each of the three policy scenarios for Maryland community colleges in teacher preparation: a historical scenario (AA only), a current scenario (AA and AAT), and a hypothetical future scenario (AAT only). These analyses addressed the study's fourth research question. In this section, major findings from each of the study's four research questions are presented, followed by a more general discussion of the relative advantages and disadvantages of each of the three policy scenarios.

Research Question 1

The study's first research question was as follows: What economic benefits and costs are associated with optimizing the transfer student pipeline in teacher preparation between Maryland community colleges and four-year institutions? What is the net present value of an "optimal completer" in Maryland? The quantitative (monetary) results for this question were presented in Tables 3, 4, 5, and 6 in Chapter 4. Optimal completers were community college students who represented maximum efficiency in the teacher education transfer pipeline: completing the equivalent of two full years at a Maryland community college (and receipt of an associate's degree), followed by the equivalent of two full years at a Maryland four-year public or independent institution (and receipt of a bachelor's degree).

The educational costs that were associated with participation in this optimal completer pipeline included tuition and fees, books and supplies, state subsidy, financial aid, foregone earnings, and foregone taxes. The per-student calculated costs for individuals in this pipeline (i.e., Maryland community college students) were $82,342, with foregone earnings as the highest cost category at $63,143. The per-student calculated costs for Maryland taxpayers were $32,011, with the state subsidy as the

highest cost category at $20,226. These calculations yielded a total societal cost of $114,353 per optimal completer in the transfer student pipeline.

In the analysis of benefits, four sets of future income streams were projected to represent the range of post-graduate outcomes among community college transfer students in this pipeline. These results were also presented in Tables 3, 4, 5, and 6 in Chapter 4. After discounting future benefits (income and taxes) to present values, the highest benefits premium was projected for graduates who did not go into teaching but worked in Maryland for some portion of time ($1,122,828), followed by graduates who left Maryland to teach or work in an alternate career field ($1,066,032), followed by graduates who taught in Maryland for some portion of time ($1,045,369), followed by graduates with career service as a teacher in Maryland ($909,355).

Depending on the employment outcome variation, the net present value for an optimal completer in the Maryland teacher education transfer pipeline ranged from a low of $795,002 to a high of $1,008,475. For individual pipeline participants, the net present value of the educational benefit (earnings premium minus educational costs) ranged from a low of $763,019 to a high of $983,690, whereas for Maryland taxpayers, the net present value of the educational benefit (tax revenue premium minus taxpayer costs) ranged from a low of -$32,011 to a high of $31,983. (The negative net present value was associated with the case variation of the optimal completer student who left the state to work after graduation, thereby failing to accrue tax revenues as future benefits to the state, but having had higher education costs subsidized via the state subsidy, financial aid, and foregone taxes.)

Since the specific policy interventions that were the focus of this benefit-cost study were intended to maximize the efficiency of the two-year to four-year transfer process and to increase the pipeline of Maryland prepared teacher candidates, only those optimal completer case variations with K-12 teaching as employment outcomes were included in the net present value calculations in Research Question 4. While economic benefits from alternate non-teaching employment routes were shown to accrue to individual students and Maryland taxpayers (i.e., projected future earnings above what would have been generated without the educational investment), these benefits did not directly support the primary goals of the policy interventions. In light of the lower net present values that were shown to be associated with teaching outcomes versus other employment outcomes in the study, later in this chapter I will explore broader structural economic barriers and incentives as they relate to the teaching profession and these policy interventions.

Research Question 2

The study's second research question was as follows: What economic benefits and costs are associated with the typical transfer student pipeline in teacher preparation between Maryland community colleges and four-year institutions? What is the net present value of a "typical completer" in Maryland? The quantitative (monetary) results for this question were presented in Tables 7, 8, 9, and 10 in Chapter 4. Typical completers were representative students, based on actual pipeline data, who followed the typical transfer path of Maryland community college students who eventually graduated with a bachelor's degree from a Maryland public or independent college or university.

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The educational costs that were associated with participation in this typical completer pipeline included tuition and fees, books and supplies, state subsidy, financial aid, foregone earnings, and foregone taxes. The per-student calculated costs for individuals in this pipeline (i.e., Maryland community college students) were $97,507, with foregone earnings as the highest cost category at $74,085. The per-student calculated costs for Maryland taxpayers were $39,016, with the state subsidy as the highest cost category at $24,781. These calculations yielded a total societal cost of $136,523 per typical completer in the transfer student pipeline.

In the analysis of benefits, four sets of future income streams were projected to represent a range of possible post-graduate employment outcomes among community college transfer students. These results were also presented in Tables 7, 8, 9, and 10 in Chapter 4, and the benefits premiums were identical to those projected for the optimal completer (since typical completers, like optimal completers, were assumed to be bachelor's degree recipients in education). Depending on the benefits premium variation, the net present value for a typical completer in the teacher education transfer pipeline ranged from a low of $772,832 to a high of $986,305. For individual pipeline participants, the net present value ranged from a low of $747,854 to a high of $968,525, whereas for Maryland taxpayers, the net present value ranged from a low of -$39,016 to a high of $24,978. Again, only those typical completer case variations with K-12 teaching as employment outcomes were included in the net present value calculations in Research Question 4.

Research Question 3

The study's third research question was as follows: What economic benefits and costs are associated with non-completers in the transfer student pipeline in teacher preparation between Maryland community colleges and four-year institutions? What is the net present value of a "non-completer" in Maryland? The quantitative (monetary) results for this question were presented in Tables 11, 12, 13, and 14 in Chapter 4. Non-completers were representative Maryland community college students who left the teacher education transfer pipeline at some point prior to bachelor's degree completion. Four types of non-completers were considered in the analysis in order to capture a range of potential paths and outcomes in the student pipeline: attrition directly following an earned associate's degree from a Maryland community college; attrition prior to attaining an associate's degree from a Maryland community college; attrition following transfer with an earned associate's degree from a Maryland community college, but prior to attaining a bachelor's degree from a four-year institution; and attrition following transfer without an associate's degree from a Maryland community college, but prior to attaining a bachelor's degree at a four-year institution.

Identical to the optimal completer case and typical completer case, the educational costs that were associated with participation in this non-completer pipeline included tuition and fees, books and supplies, state subsidy, financial aid, foregone earnings, and foregone taxes. Since each variation of the non-completer was projected to drop out of the higher education pipeline at a different point in time, however, the cost calculations were unique to each individual case variation. The per-student calculated costs for the first variation of the non-completer case (attrition directly following an earned associate's

degree from a community college) were $34,739 for individuals and $8,169 for Maryland

taxpayers, for a net societal cost of $42,908. The per-student calculated costs for the

second variation of the non-completer case (attrition prior to attaining an associate's

degree from a community college) were $6,947 for individuals and $1,633 for Maryland

taxpayers, for a net societal cost of $8,580. The per-student calculated costs for the third

variation of the non-completer case (attrition following transfer with an earned

associate's degree from a community college, but prior to attaining a bachelor's degree)

were $45,647 for individuals and $13,466 for Maryland taxpayers, for a net societal cost

of $59,113. The per-student calculated costs for the fourth variation of the non-completer

case (attrition following transfer without an associate's degree from a community college,

but prior to attaining a bachelor's degree) were $17,855 for individuals and $6,930 for

Maryland taxpayers, for a net societal cost of $24,785.

In the analysis of benefits, since non-completing students in this pipeline would

not be expected to pursue K-12 teaching as a profession (and in fact would be ineligible

for teacher certification due to not having attained a bachelor's degree), the future

earnings premiums were assumed to come from alternate career fields, commensurate

with the projected level of educational attainment (over a high school diploma) for each

case variation. These results were also presented in Tables 11, 12, 14, and 14 in Chapter

4. After discounting future benefits (income and taxes) to present values, the highest net

societal benefits premium was projected for the two non-completer case variations of

students who had earned an associate's degree, at $524,254 per student, while for the two

non-completer case variations of students who had not earned an associate's degree, the

net societal benefits premium was $316,530 per student.

Finally, the net present values for non-completers in the teacher education transfer pipeline ranged from a low of $291,745 (for students who transferred without an associate's degree, and did not subsequently earn a bachelor's degree), to a high of $481,346 (for students who earned an associate's degree, but did not subsequently transfer). For individual pipeline participants, the net present value ranged from a low of $281,545 to a high of $461,317, whereas for Maryland taxpayers, the net present value ranged from a low of $10,200 to a high of $20,029. While the non-completer cases did not directly factor into the net present value calculations of the three policy scenarios in Research Question 4, since none of these students would be eligible to become teachers, they were used in the exploratory pipeline efficiency calculations that were associated with Research Question 4, and are also discussed below in the comparison of net present values by level of educational attainment.

Comparison of Net Present Values across Representative Student Cases

The direct relationship between levels of educational attainment and average lifetime earnings is well-documented in U.S. census population data (Bureau of the Census, 2008) and well-established in the research literature on the economics of education (Schultz, 1963; Becker, 1964, 1975, 1993). Building on this vein of research, this study used the methods of benefit-cost analysis to monetize the costs that were associated with various student pathways through higher education against anticipated future benefits. The findings showed that the societal net present values that were associated with higher levels of educational attainment (and more efficient pathways for attainment) exceeded those of lower levels of educational attainment, even though the

costs that were associated with higher levels of educational attainment were greater for both students and taxpayers.

As an added contribution to the existing research in this field, this study also considered marginal differences in net present values as they related to efficiencies in the Maryland community college student transfer pipeline in teacher education. Optimizing the pipeline (Research Question 1) increased the net present values in each of the representative cases that were presented in Chapter 4, while typical completion (Research Question 2) and non-completion (Research Question 3) decreased these values. In fact, the calculated net present values for society were two times (or in some cases three times) higher for all types of pipeline completers (Tables 3 through 10) than for non-completers (Tables 11 through 14) in the study. Predictably, increasing time-to-degree and student credit hours (due to course redundancy) increased costs and decreased net present values, and this study illuminated the extent to which these economic inefficiencies were projected to affect students, taxpayers, and society. Not surprisingly, the lowest calculated net present values in the study were associated with those students who attended college, but completed neither the associate's degree nor the bachelor's degree (Tables 12 and 14).

As part of the calculations for determining the costs for each of the 12 student cases presented in Chapter 4, foregone earnings and taxes were considered. One of the limitations cited by Schultz (1963) in earlier human capital studies was the omission of foregone earnings—income that would have been earned through employment if the student were not in school—which he asserted had consistently led to overinflated returns to education. In 1956 dollars, Schultz estimated that foregone earnings represented

approximately 60% of the total cost of four years of high school education ($852 in annual foregone earnings), and 59% of the total cost of four years of college education ($1,947 in annual foregone earnings). In comparing Schultz's findings to the findings in the current study, foregone earnings and taxes in the benefit-cost analysis accounted for 59% (or $67,923 of $114,353) of the optimal completer's costs for the equivalent of four years of college education, and 58% (or $79,693 of $136,523) of the typical completer's educational costs. While these studies were approximately 50 years apart, it was interesting to note that the foregone earnings calculations for the bachelor's degree in the current study were comparable to Schultz's 1956 findings.

Higher education has been characterized in the literature as both a private and public good, meaning that there are benefits resulting from its consumption that are expected to accrue both to individuals and to broader society (Bowen, 1977; Leslie & Brinkman, 1988). The benefit-cost framework utilized in this study was aligned with this view of higher education, with portions of the benefits and costs being assigned privately (to individual program participants in Maryland) and publically (to taxpayers in Maryland). Across all 12 of the representative student cases that were presented in this study, the net present values for the educational investment were positive to individuals, varying from a high of $983,690 (for community college students who earned both an associate's degree and a bachelor's degree, but did not teach) to a low of $281,545 (for community college students who transferred to a four-year institution without an earned associate's degree, and did not subsequently earn a bachelor's degree). In 10 of the 12 cases, the net present values for the educational investment were positive for Maryland taxpayers, with the highest value at $31,983 for optimal completers with career service as

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a Maryland teacher. In two of the student case categories, the net present values were

projected to be negative for taxpayers—for optimal completers (-$32,011) and typical

completers (-$39,016) who left the state altogether after graduation and were not

expected to accrue future tax benefits for the state.

These latter findings (negative net present values for Maryland taxpayers) raise

interesting observations about the economic costs that are associated with state support

for higher education, given the reality that a certain percentage of students across all

segments of higher education will leave the state to work elsewhere after graduation.

Recent follow-up surveys of Maryland bachelor's degree recipients revealed that 75% of

graduates who were originally Maryland residents were working in Maryland one year

following college graduation, while only 25% of graduates who were not originally

Maryland residents were working in Maryland one year following college graduation

(MHEC, 2009b). For graduates of Maryland community colleges (the majority of whom

were already Maryland residents), the comparable in-state post-graduate employment

figure was 80% (MHEC, 2007d). Through the calculation of various benefits premium

scenarios for optimal completers, typical completers, and non-completers in Tables 3

through 14 in Chapter 4, this study showed that there were economic consequences

related to these post-graduate migration patterns, which, in two cases, resulted in negative

net present values for the higher education investments made by Maryland taxpayers.

The issue of post-college migration to other states is also of significance as it

relates to the state's K-12 teacher workforce, since Maryland is a state whose colleges

and universities do not produce a sufficient number of K-12 teachers to meet workforce

demands, and therefore relies heavily on out-of-state teacher recruitment. For example,

among the 4,143 new teacher hires in Maryland public schools during the 2009-2010

school year, only 812 (20%) were newly prepared teachers from Maryland colleges and

universities (MSDE, 2010). The remaining hires were newly prepared teachers from out-

of-state (non-Maryland) higher education institutions (839 teachers, or 20% of the pool);

experienced teachers who were already residing in Maryland (1,767 teachers, or 43% of

the pool); and experienced teachers who were from out-of-state (725 teachers, or 17% of

the pool) (MSDE, 2010). The broader implications of these trends as they relate to the

economics of the K-12 teacher workforce, which are beyond the immediate scope of this

benefit-cost analysis but raise significant issues for further research in the field, are

explored later in this chapter.

Also related to the analysis and discussion of the study's findings is the

observation that a little over half of all Maryland community college students who

transfer to a Maryland four-year public college or university eventually earn a bachelor's

degree within five years of transferring. Among the 2004-2005 cohort of Maryland

community college transfer students, for example, only 54.8% of the students had earned

a bachelor's degree within five years of transferring (MHEC, 2011). Given these trends

within the transfer student pipeline, this study revealed that having an associate's degree

in hand was a good economic decision for students, even if they did not eventually pursue

or attain a bachelor's degree. At the same time, however, this outcome (non-completion

of the bachelor's degree) did not contribute positively to the policy goal of producing

more K-12 teacher candidates through Maryland's two-year to four-year teacher

preparation transfer pipeline.

For example, among students in the four non-completer case categories in the benefit-cost analysis, the per-student net present value for those who earned an associate's degree alone was $481,346; among students who earned an associate's degree and then transferred to a four-year institution, but did not subsequently complete a bachelor's degree, the per-student net present value was $465,141. In comparison, among those students who entered the community college pipeline but did not complete an associate's degree, the pre-transfer net present value was $307,950 per student, while the post-transfer net present value was $291,745 per student. (The net present value was lower in this latter case since these students were projected to incur higher costs for completion of partial coursework at the four-year institution, without accruing a higher benefits premium for completion of the full bachelor's degree.)

The economic benefits that were associated with the associate's degree likewise extended to a portion of the bachelor's degree receipts in the study. Among the representative completers in the study who optimized the pipeline (with an earned associate's degree prior to transferring and earning a bachelor's degree), their total higher education costs were projected to be $22,170 less than the costs of representative typical completers (who transferred at the more typical point of transfer), when factoring in the educational costs that were associated with attaining the bachelor's degree (i.e., tuition and fees, books and supplies, state subsidy, financial aid, foregone earnings, and foregone taxes). The differences in the two-year versus four-year per-credit tuition cost rates alone would yield significant savings for bachelor's degree recipients who completed the first half of their degree at a community college, as would the differences in the two-year versus four-year state subsidy cost rates for Maryland taxpayers.

In summary, for all 12 of the representative student cases that were presented in this study (optimal completers, typical completers, and non-completers), Maryland community college students in the higher education pipeline who earned neither an associate's degree nor a bachelor's degree had lower projected benefits premiums than those students who completed at least an associate's degree. Correspondingly, their net present values to society were lower than those of students who completed either an associate's or bachelor's degree (or both), even after all of the associated costs for attaining these degrees were taken into account.

Research Question 4

The study's fourth research question analyzed the relative economic value of each of the following three policy scenarios for Maryland community colleges in teacher preparation: (a) Maryland community colleges retain their traditional role in K-12 teacher preparation by providing lower-division transfer courses and programs (historical role for Maryland community colleges); (b) Maryland community colleges expand their traditional role by offering the AAT degree in addition to providing lower-division transfer courses and programs (current role for Maryland community colleges); and (c) Maryland community colleges offer the AAT degree as the lower-division requirement for students seeking admission into teacher preparation programs at four-year colleges and universities (hypothetical future role for Maryland community colleges).

The quantitative (monetary) results for projecting the economic value of the historical role for Maryland community colleges were presented in Tables 15, 16, and 17 in Chapter 4. This scenario assumed that Maryland community colleges would have provided traditional lower-division AA transfer courses and programs in teacher

education during the 2004-2005 academic year, minus the availability of the AAT degrees. A model teacher preparation transfer pipeline was created for this analysis using proportional levels of educational attainment that Maryland community college students were projected to reach under this historical scenario. A total of 82.6% of the community college students in this model pipeline were projected to be non-completers (i.e., exiting the teacher preparation pipeline at some point prior to bachelor's degree attainment), while 17.4% were projected to be completers (i.e., graduating with a bachelor's degree). A total of 5.6% of the students in the original community college teacher preparation transfer pipeline under this historical scenario were expected to teach in Maryland for some period of time after completing a bachelor's degree, which translated to low end estimates of 152 new teachers, mid range estimates of 174 new teachers, and high end estimates of 227 new teachers, based on assumptions about the growth of the pipeline had the AAT not been in place during the 2004-2005 academic year.

Applying the benefit-cost data from the first three research questions in the study, the weighted net present value per student enrollee in the pipeline under the historical scenario for Maryland community colleges was calculated as $443,098. For community college students who were expected to teach in Maryland for some period of time after earning a bachelor's degree from a four-year institution, the net present value was $908,846. This led to the calculation of an economic inefficiency factor of 51% for the entire transfer pipeline, which was the average net present value loss of $465,748 for every pipeline participant who did not become a teacher in Maryland, or the net present value difference between $908,846 for teaching and $443,098 for alternative employment and attainment outcomes.

A series of analyses were also conducted in Chapter 4 to project the economic

value of the current role for Maryland community colleges in K-12 teacher preparation.

This second scenario assumed that both the traditional AA and the AAT would have been

in place as program options for Maryland community college students in teacher

education during the 2004-2005 academic year. The data indicated that since the

introduction of the AAT, the early stages of the teacher education pipeline have grown in

Maryland community colleges in terms of student enrollments and associate's degree

production, while transfer rates to four-year institutions have not noticeably increased.

Looking at a subset of state-level attainment data for USM four-year public institutions,

Table 18 showed that while 29% of USM bachelor's degree recipients in elementary

education in FY01 had originally transferred from a Maryland community college, by

FY08, this proportion had decreased to 19%. Overall, these data showed a 25% decrease

in the number of elementary education bachelor's degree recipients between FY01 and

FY08 (from 590 graduates to 442 graduates), and a 51% decrease in the number of

bachelor's degree recipients who were originally transfer students from Maryland

community colleges (from 173 graduates to 85 graduates). Statewide, the number of

teacher candidates graduating from Maryland public and independent four-year

institutions has remained relatively constant since the introduction of the AAT, while the

number and proportion of newly prepared Maryland teacher candidates going into

teaching in Maryland public schools has actually declined (MSDE, 2010). While more

Maryland community college students had entered the teacher preparation pipeline and

attained associate's degrees in education during the timeframe that was considered for

this benefit-cost study, these developments had not yet translated into higher student transfer rates, bachelor's degree attainment rates, or K-12 teacher production rates.

In terms of college increased attainment in general since the introduction of the AAT, the net present value of $481,346 that was associated with associate's degree recipients, regardless of whether they eventually transferred, was $173,396 higher than for students who left college prior to attaining an associate's degree, and $189,601 higher than for students who transferred to a four-year institution without an associate's degree and did not subsequently complete a bachelor's degree. While earning an associate's degree without a bachelor's degree was not projected to directly benefit the teaching profession in terms of producing more certified teachers, it did return a higher net present value both to individuals and to society than did college attendance alone without an earned associate's degree, even after all educational costs were taken into account. Since the extent to which the AAT has influenced the progression of Maryland community college students beyond the associate's degree level is still evolving, the net present value data that were presented in Table 17 were projected to provide an appropriate representation for the current role of Maryland community colleges, given the benefit-cost framework and methods in this study. Table 17 included future attainment projections for the entire population of Maryland community college AAT and AA enrollees (4,046 students) in FY05, with a weighted net present value of $443,098 per pipeline participant, a weighted net present value of $908,846 per pipeline teacher, and the projected number of pipeline teachers employed in Maryland at 227.

Finally, a series of exploratory analyses were conducted in Chapter 4 to project a hypothetical future role (not currently under consideration) for Maryland community

colleges in K-12 teacher preparation. This third policy alternative assumed that

completion of an AAT degree would become the sole program pathway for Maryland

community college students seeking transfer into a teacher preparation program at a four-

year institution. Moving teacher candidates toward optimal degree completion, which

included attainment of both the associate's and bachelor's degrees, yielded a net present

value of $931,016 (high-end value based on full-time college attendance), versus

$908,846 for the typical completer (who may or may not have earned an associate's

degree). When considering the potential net present value increase of $22,170 per

teacher multiplied across the cohort of 227 Maryland teachers that was projected from the

pipeline, assuming that all of the teacher candidates in this pipeline had moved toward

associate's degree completion prior to transferring to a four-year institution, the increase

in the net present value for the entire pool of teachers would be $5,032,590 (i.e., the

difference in the aggregate net present value of $211,340,632 for optimal completers and

$206,308,042 for typical completers).

However, given that the majority of Maryland community college students

transfer without first attaining an associate's degree (and would no longer be eligible to

transfer to a four-year teacher education bachelor's degree program under this

hypothetical future scenario), further projections were necessary. Examining FY05 data,

four years after the initial implementation of the first AAT degrees, a total of 346

Maryland community college students graduated with an AAT or AA degree in

education, while a total of 589 Maryland community college education majors transferred

to a USM four-year public institution (USM, 2006). Using the assumptions that all 346

of these AAT or AA degree recipients transferred over the five-year period, and 86%

(298 students) did so to USM four-year public institutions in proportion with prevailing

transfer trends (MHEC, 2004a), the difference would yield 291 teacher education transfer

students who had transferred without an associate's degree, or 49% of the transfer pool.

Applying the potential loss rate of 49% to the entire pipeline of 4,046 Maryland

community college students who were enrolled in teacher education transfer programs in

FY05, the AAT-only policy could translate into the loss of approximately 111 teachers

(or 49% of the 227 teachers who were projected to graduate and teach in Maryland public

schools). In addition, the potential net present value reduction could be up to $623,066

per lost teacher, calculated as the net present value difference between $931,016

(community college students who optimized the pipeline and taught in Maryland for a

period of time) and $307,950 (community college students who left the pipeline prior to

attaining an associate's degree). While some percentage of Maryland community college

students in the pipeline would likely choose to convert to the AAT completion pathway if

this were the only program option available to them, it was unclear how many students

would ultimately make this choice, and under what circumstances.

Advantages and Disadvantages to Each Policy Scenario

Having discussed the quantitative findings from the fourth research question in

this study, which pertained to the relative economic value of each of the three policy

scenarios for Maryland community colleges using benefit-cost analysis, this section

examines the advantages and disadvantages of the three policy scenarios from a broader

educational perspective. This section begins with a discussion of the historical role of

Maryland community colleges (first policy option), followed by the current role of

Maryland community colleges (second policy option). It concludes with a discussion of

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the hypothetical future role of Maryland community colleges (third policy option).

Following this discussion, this chapter continues with an examination of major

conclusions that can be drawn from this benefit-cost study, and its potential implications

for policy, practice, and further research.

First, under the historical role of Maryland community colleges in teacher

education prior to the introduction of the AAT, students enrolled in lower-division

courses or transfer programs in order to prepare them to transfer to a four-year college or

university. It was not required that community college students complete an entire

academic program or degree in order to transfer, as they could apply for admission to a

four-year institution at any point in time before attaining their associate's degree.

Transfer programs in teacher education prepared community college students to complete

their general education requirements (which would be accepted by any four-year

institution in Maryland without the need for course-by-course review) as well as many of

their lower-division requirements for teacher certification at the bachelor's degree level.

While individual community colleges articulated these transfer preparation programs

with individual four-year institutions, there was no uniform program, curriculum, or set

of statewide requirements that could guarantee that a community college student had met

the lower-division degree requirements for education prior to transfer. Thus, students

could anticipate either losing some of their course credits in transfer or having to take

additional lower-division teacher education requirements at the four-year institution prior

to beginning an education major, which has costs to both the individual student and to

society.

There are certain advantages that are associated with the historical approach to teacher education at Maryland community colleges. Namely, students could transfer to a four-year institution at any point in the community college pipeline. Without having any specific exit requirements from the community college, students only had to meet the admissions standards of the four-year institution (and its teacher education program) to which they were seeking to transfer. In addition, although participation in or completion of teacher education programs at Maryland community colleges provided no guarantees for a seamless transfer, they had been articulated with the state's four-year institutions to maximize the possibility that students would receive a comparable educational experience to that at a four-year institution.

At the same time, however, there are several disadvantages to this historical approach for Maryland community colleges. Since these various transfer programs did not share a common curriculum or a standard set of learning outcomes across institutions, community college students either stood to lose credits in the transfer process or to complete redundant coursework at a four-year institution. Moreover, they entered the four-year institution with uneven levels of preparation. Since transfer students entered four-year colleges and universities at various points in the undergraduate pipeline (e.g., as freshmen, sophomores, or juniors), the sequencing of such education major requirements as field experiences, internships, and student teaching was challenging and often placed students at a disadvantage with respect to the timely completion of their degree requirements. Furthermore, on average, only 25% of the students who originally entered Maryland community colleges over the 10 years prior to the introduction of the AAT eventually transferred to a four-year institution in the state (MHEC, 2005b). Among

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those who transferred to a four-year institution during this same time period, only half ended up graduating with a bachelor's degree within four years of transferring (MHEC, 2005c).

Second, under the current role of Maryland community colleges in teacher education, students have multiple pathways into a Maryland four-year institution: taking courses and transferring, completing the traditional AA transfer preparation program in teacher education (or another academic field) and transferring, or completing the AAT degree and transferring. Also, students still have the option of enrolling in either the AA or AAT and transferring to a four-year institution without the completed degree in hand. Thus, while transfer options into teacher education programs in the state's four-year institutions remain flexible, the AAT presents a more efficient route since it has been designed to articulate with elementary and secondary teacher education programs at each four-year institution in the state. By statewide agreement, all credits in the AAT are accepted in transfer without the need for course-by-course review, and transfer students are able to enter the four-year institution with class standing as a junior. These students are able to progress directly into the upper-level curriculum of the education major and finish the entire bachelor's degree within two additional years of full-time equivalent enrollment. At the same time, however, students who choose to complete the AAT degree have two additional exit requirements from the community college that are not required of other students: a minimum grade point average of 2.75 and a passing score on the national Praxis I teacher examination.

An advantage of the current role of Maryland community colleges in teacher preparation is that students now have multiple points of access into the pipeline.

Community colleges are typically more flexible than four-year institutions with course offerings in the evenings, weekends, and online, which holds appeal for a wide range of potential students, particularly nontraditional working adult students. For those students who are certain that they want to transfer to a Maryland four-year institution to pursue teacher education, the AAT is an attractive option since it satisfies the lower-division degree requirements for all education bachelor's degree programs in the state. For those students who do not decide to commit to an education major until a later point in time, they still have the option of transferring to a Maryland four-year institution, either with or without a completed AA or AAT degree.

In addition, the sheer numbers of community college students who are in the teacher preparation pipeline under this current policy scenario are larger than they have ever been, totaling 4,046 community college students during the initial academic year (2004-2005) that this study was positioned (MHEC, 2005d). During the five years (1997-2001) prior to the introduction of the AAT, teacher education transfer preparation programs enrolled an annual average of 3,025 community college students statewide (MHEC, 2005d). Over the long term, these upward trends may result in even larger numbers of community college students transferring into education programs at four-year institutions, earning bachelor's degrees, and ultimately becoming teachers.

In terms of potential disadvantages to the current role for Maryland community colleges, it is possible that administering parallel teacher education programs at community colleges (i.e., both the AA and AAT) is not the most efficient use of institutional resources. It is unclear whether students who graduate with an AAT are treated preferentially in the admissions process at four-year institutions over students who

graduate with a traditional AA or who transfer without an associate's degree. If so, what are the implications for advising community college students about their various transfer options? Additionally, elementary education, which represents the vast majority of AAT program enrollments, is not currently an area of critical shortage for teachers in the State of Maryland. Over the past several years, the supply-demand data have been balanced relative to the teacher candidate supply and the number of teaching positions available in the state's elementary schools; in some years, a surplus of elementary teacher candidates has even been projected (MSDE, 2008a). What are the broader economic and social implications if these Maryland-prepared students are unable to find teaching jobs in the state upon graduation?

On the other hand, increasing the number of teacher candidates who already reside in Maryland (i.e., the majority of community college students are Maryland residents) and who are educated in Maryland may decrease the state's long-term and heavy reliance on importing teachers from other states or other countries. Among new teacher hires in Maryland public schools during the 2009-2010 school year, for example, only 20% of beginning teachers were Maryland-prepared (MSDE, 2008a). In comparison, 20% of new hires were beginning teachers from other states or countries, 17% were experienced teachers from other states or countries, and 43% were experienced teachers who had last taught in Maryland. In particular, Maryland has increasingly relied on international recruitment for hiring teachers in difficult-to-staff school districts and in shortage disciplines such as secondary science. According to a report from the American Federation of Teachers (2009), Maryland public schools employed approximately 1,200 teachers from the Philippines alone in 2009, the majority of whom worked in Baltimore

City Public Schools and Prince George's County Public Schools. There are substantial

costs to school districts that rely on international teacher recruitment and placement,

including visa filing fees, immigration attorney fees, and agency placement fees.

Third, under the hypothetical future role of Maryland community colleges in

teacher education, the AAT would become the sole pathway for community college

students who want to transfer to a Maryland four-year institution to major in education.

Students would no longer have the option of enrolling in traditional AA transfer

preparation programs in teacher education, nor would they be able to transfer into a

teacher education program at a Maryland four-year institution without first completing

the AAT degree. Under these assumptions, AAT graduates from community colleges

would enter a four-year institution with their general education and lower-division

requirements complete, with their transfer credits accepted in full, and with junior class

standing. While this is not a policy option that is currently under consideration in

Maryland, it is included in the study because it raises interesting questions about the

extent to which these developments would potentially impact the existing educational

pipeline in teacher education.

The consideration of this hypothetical future scenario for Maryland community

colleges presents both advantages and disadvantages. In terms of advantages, it provides

greater assurances that all community college students would enter teacher education

programs at four-year institutions with similar levels of academic preparation. In theory,

these students should be better prepared to transfer to a four-year institution and have a

shorter time-to-degree than traditional community college students since their transfer

credits would be accepted in full and their lower-division requirements would be

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complete. Receiving four-year institutions would not have to engage in lengthy transcript analyses or extensive placement decisions with these entering students since the AAT curriculum has already been articulated with every college and university statewide. These AAT graduates would likely gain acceptance into the Maryland four-year institution of their choice, thereby possibly increasing the number of associate's degree recipients who transfer fully prepared to enter the teacher education curriculum for the bachelor's degree (i.e., having attained a 2.75 cumulative GPA or higher in their AAT coursework, and having passed the Praxis I teacher examination while still enrolled at the community college). Thus, screening teacher education students from community colleges earlier in the pipeline via the AAT may save resources, both individual and institutional, in the long-run.

The major disadvantage of the third policy scenario in this study, the AAT-only approach, is that it would decrease the current range of options for entry into the teacher education pipeline by requiring that community college students complete an entire associate's degree program before transferring to a four-year institution. As previously discussed, the majority of Maryland community college students currently transfer prior to attaining an associate's degree. Additionally, many community college students remain undecided about their major and may not be prepared to make a commitment to teaching during their first or second year of college enrollment. If students decide that they want to pursue an education major at a four-year institution after having completed a few community college courses or even another associate's degree program, their transfer options would be more limited under this scenario. In fact, their projected time-to-degree would likely increase, particularly if they would be required to take extra courses at the

community college in order to earn the AAT. Thus, while this scenario may improve the quality of preparation of community college students in the pipeline, it may also create inefficiencies and ultimately restrict student access to four-year institutions.

Conclusions

Using benefit-cost analysis, this study demonstrated that maximizing the efficiency of community college student progression through the higher education pipeline has real economic consequences for students, taxpayers, and society. Responding to President Barack Obama's, February 24, 2009, declaration to a joint session of Congress that the United States will once again lead the world in having the highest proportion of college graduates (55%) by 2020 (White House Press Office, 2009), getting more students into and through higher education has become a high priority for Maryland and other states. In fact, President Obama's college attainment goal was included in the 2009 *Maryland State Plan for Postsecondary Education* as one of Governor Martin O'Malley's goals for the state (MHEC, 2009e). At the national level, major initiatives such as the "College Productivity Program" (funded by the Lumina Foundation); "Complete College America" (funded by the Bill and Melinda Gates Foundation, Carnegie Corporation of New York, Ford Foundation, Lumina Foundation for Education, and W. K. Kellogg Foundation); and "Access to Success" (led by the National Association of System Heads and The Education Trust), have further placed the issues of higher education efficiency and college completion into the national spotlight.

Given the heightened emphasis on efficiency and completion in higher education, coupled with rising costs and increasing selectivity in four-year colleges and universities, it is inevitable that an ever increasing focus has come to bear on community colleges as a

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major driver for educational attainment in the United States. With their community-

based roots and their mission to contribute to workforce development and extend access

to higher education, community colleges are well positioned to make substantial

contributions to the national college completion agenda. In October 2010, for example,

the first White House Summit on Community Colleges was held, which brought together

leaders from a range of governmental, educational, and community sectors to focus on

the importance of community colleges in providing workforce training, serving non-

traditional students, and extending access to higher education. Also in 2010, the Bill and

Melinda Gates Foundation launched "Completion by Design," a five-year, $35 million

initiative to raise graduation rates among low income community college students in nine

states. As summarized in a recent report issued by the College Board (2011), "As the

nation prepares to meet President Obama's goal of eight million new college graduates

by 2020, the transfer process—the pathway between community colleges and four-year

institutions—will take on an increasingly vital role" (p. 4).

In fall 2008, over 6.6 million students were enrolled in public community colleges

in the United States, an increase of 42% over community college enrollments during the

previous decade (Chronicle of Higher Education, 2010). During this same year (fall

2008), Maryland's 16 public community colleges enrolled more than 128,000 students,

accounting for 47% of all undergraduate student enrollments in the state (MACC, 2009).

These data convincingly demonstrate that community colleges provide a needed and

increasing point of access into higher education for growing numbers of students. Upon

entering higher education, national surveys have projected the percentage of community

college students intending to eventually earn a bachelor's degree at between 50% and

80% (College Board, 2011). The reality, however, is that pipeline studies show that only 10% of students who initially enter higher education through a community college end up earning a bachelor's degree (Kahlenberg, 2010).

Since teacher education students must progress through the higher education pipeline to bachelor's degree completion in order to work in the teaching profession, regardless of whether they began their studies at a community college or four-year institution, the economic efficiency of the pipeline was a valid issue for consideration, and therefore was the central focus of this study. A series of Maryland-specific student transfer pipeline models were presented in Chapter 4, which tested the extent to which economic benefits and costs were sensitive to varying paths of student progression through higher education. This resulted in the creation of three representative student categories: optimal completers (Research Question 1), typical completers (Research Question 2), and non-completers (Research Question 3). As the projected efficiency of Maryland's community college student pipeline models increased (from non-completers, to typical completers, to optimal completers), so did the projected net present values that were associated with each of these three models. In fact, the calculated net present values to society were almost twice as high for all types of completers (Tables 3 through 10) than for non-completers (Tables 11 through 14) in the pipeline. Predictably, increasing time-to-degree and credit hours (due to course redundancy) increased costs and decreased net present values, and this study shed light on the extent to which these inefficiencies impact students, taxpayers, and society from an economic perspective. Also not surprisingly, the smallest net present values in the study were associated with those

student cases that represented non degree completion at either the associate's or bachelor's degree levels (Tables 13 and 14).

Applying these benefit and cost models to the teacher education transfer pipeline, Research Question 4 examined the extent to which the AAT program, by design, was projected to impact the net present value of AAT program participation versus alternatives routes for student completion or non-completion. From the data that were available and analyzed for Research Question 4 (pertaining to the historical, current, and hypothetical future roles for the AAT), more Maryland community college students were beginning and completing teaching degrees at the associate's degree level than before the AAT was introduced in 2001. In addition, more Maryland community college students (in all degree fields) were transferring to four-year institutions, although bachelor's degree completion rates among these transfer students had remained relatively stable over that time period. In terms of teacher education program graduates from Maryland four-year institutions (which include students who originally entered the higher education pipeline in Maryland community colleges), these numbers had remained relatively stable since 2001.

When applying these parameters to the AAT in Chapter 4 (the results of which were summarized earlier in this chapter in the "Discussion" section), it was clear that more systematic tracking of students in the pipeline should be in place before more definitive conclusions were made about the long-term economic value of the AAT versus other pipeline alternatives (i.e., the traditional AA degree). Tracking the progression of individual teacher education students from initial community college enrollment, through associate's degree completion and/or transfer, through bachelor's degree completion, and

through entry into the teaching profession, would provide a more nuanced understanding of the AAT program impact versus alternative routes from an economic efficiency standpoint. This topic is discussed further in the "Recommendations for Future Research" section later in this chapter.

While the issues associated with the reasons why teacher education students drop out of the higher education pipeline, or whether in fact there is an "ideal" educational attainment rate for society, are of critical social and economic importance, they are beyond the central scope and focus of this study. Other corollary issues to this study include the broader structural economic issues that shape the teacher education landscape outside of the initial teacher preparation context in higher education. For example, there is the economic workforce issue of teacher supply and demand. While there are documented shortages of K-12 teachers in many fields and in many geographic areas in Maryland and elsewhere in the United States (MSDE, 2008a), these shortages are not universal and often result from the lack of alignment between teacher supply and position demand at any given time (Curran et al., 2000; Darling-Hammond, 2001b). As discussed in Chapter 1, there are currently no shortages of elementary school teachers in Maryland, and in some years, surpluses of elementary school teachers have been projected. While no one likely would argue against increasing pipeline efficiency or improving educational quality as important goals for teacher preparation programs (both of which are goals of the AAT), increasing the actual supply of elementary school teachers has not been framed as a priority for Maryland. As explained in Chapter 1, several AAT programs have been developed and offered in secondary certification areas since the initial introduction of the AAT in elementary education in 2001. Three of these secondary AAT programs are in

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subjects that MSDE (2008a) has deemed to be critical shortage areas for Maryland: chemistry, mathematics, and physics. Since these programs are relatively new, their potential contributions toward resolving teacher shortages in Maryland remain to be seen, and they will require longitudinal tracking as secondary AAT students graduate from community colleges and continue to progress through the educational pipeline.

Moreover, there are broader structural economic issues related to occupational pay and prestige that shape the teacher education pipeline and workforce. Teacher attrition has been estimated at 30% to 50% within five years of entering the profession, and the percentage of prospective candidates who complete teacher education programs in college but never take teaching job has been estimated at 40% (Curran et al., 2000). A 2007 study by the National Commission on Teaching and America's Future (NCTAF) estimated the annual cost of teacher turnover in the United States at $7.3 billion, in order to cover recruiting, hiring, processing, and training new teacher hires (NCTAF, 2007). In examining reasons why K-12 teachers choose to leave the profession, researchers have cited such factors as job-related stress, poor working conditions, excessive bureaucracy, growing job demands, lack of financial incentives, and noncompetitive salaries (Darling-Hammond, 2001a). In the current study, alternate salary returns for teachers (Tables 5 and 9) were projected to be higher than for those teachers who taught during their entire careers (Tables 3 and 7), or for those teachers who taught during a portion of their careers (Tables 4 and 8). Thus, economic factors related to teacher attrition are important to consider in addition to the economics of the initial higher education preparation pipeline, to avoid the loss of benefits that should accrue to society as a whole from having a stable teaching workforce.

Using benefit-cost analysis to compare the benefits, costs, and net present values

for a range of educational pipeline options and educational attainment levels in Maryland,

this study documented that more education, in and of itself, generated positive economic

outcomes both for individuals and for society. For the moment, one can conclude that the

AAT, by design, provides a viable and more efficient alternative to the traditional two-

year to four-year transfer path followed by the typical community college student,

although both options (i.e., the AAT and the traditional AA) currently remain open to

teacher education students in Maryland. The degree to which community college

students ultimately utilize and benefit from the AAT remains to be seen as more

community college students progress through the transfer pipeline over time. The long-

term resulting impact on the teacher pipeline in Maryland—both in teacher preparation

programs in four-year colleges and universities and in the K-12 teaching workforce—also

remains to be seen.

Implications of the Study

This study has several implications for the analysis of educational policy. There

are many models that provide a framework or context from which to analyze the planning

and implementation of educational policy decisions, including rational perspectives,

political perspectives, and normative perspectives (Malen & Knapp, 1997). For example,

when considering the policy issues in this study from a rational perspective, one would

focus on the extent to which each of the three policy alternatives solves an identified

problem, namely, in this study, inefficiencies in the articulation of education programs

between community colleges and four-year institutions. In other words, one would seek

to determine which policy alternative would maximize the response in addressing the

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issue at hand. In comparison, when considering the policy issues in this study from a political perspective, one would focus on the interplay among various key constituencies (e.g., students, K-12 schools, community colleges, four-year institutions, taxpayers) by determining whose interests would be best served by the selection of one policy alternative over another. The end result of such an analysis would be a better understanding of the implications of selecting one option over another in terms of gains and losses across different groups that are involved in the policy process. On the other hand, when considering the policy issues in this study from the normative perspective, the three policy alternatives would be evaluated in light of the social values, needs, and objectives that each seeks to address. Through this lens, one would expect that such issues of social importance as student access, teacher effectiveness, educational quality, and institutional autonomy would weigh heavily in the consideration of each policy alternative.

Against the backdrop of the three models described above, the economic approach used in this study, benefit-cost analysis, brings several unique strengths and perspectives to the analysis of educational policy. Benefit-cost analysis provides a systematic framework for comparing the pros and cons of various policy options. It takes the needs and interests of various stakeholder groups into consideration and seeks to find the best possible solution for a given policy issue. Unlike the aforementioned approaches, however, the underlying framework of this model builds upon a series of objective, quantitative factors that take the form of monetary benefits and costs. It requires the collection and comparison of benefit and cost data for individuals who are directly affected by the policy decision as well as those who are indirectly affected by the policy

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decision. Per the "fundamental rule" of benefit-cost analysis, the policy alternative that should be selected is the one that produces the greatest net benefit to society (i.e., the sum of all stakeholder groups) as measured in economic terms (Gramlich, 1990). While political, social, and other factors may be considered to the extent that they have an impact on the economic measures in the analysis, they are not used to evaluate the outcomes of policy decisions in this study.

Economic approaches to policy analysis are particularly useful and appropriate when considering the impact of policy decisions on the distribution of resources across different stakeholder groups (Gramlich, 1990). More specifically, the model used in this study provides a framework for evaluating economic benefits and costs for students, taxpayers, and society related to alternative models for community college involvement in teacher preparation. Moreover, the study analyzes and projects the potential effects of these policy decisions in such areas as likelihood of entering the teaching profession and student transfer, retention, and graduation rates. While there are notable limitations to the economic approach (see the discussion of "Methodological Limitations" in Chapter 3), making it subject to the same flaws and constraints that characterize all human decision-making processes, it provides an objective rationale for the selection of one policy alternative over another through using a standard set of measures that serve as a basis for the analysis.

In addition to the implications for educational policy analysis described above, the results of this study are of potential value to several other stakeholder groups, including educational leaders and policymakers, legislators who make funding decisions about such programs, and students who seek these degrees. First, educational leaders and

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policymakers lack general consensus on what the role of the nation's community colleges

should be in the preparation of future teachers. With limited financial resources in both

the K-12 sector and higher education, opportunity costs are associated with pursuing one

course of action over another. Using Maryland's experience with the AAT, this benefit-

cost study provides one potential framework for evaluating policy alternatives from an

economic perspective. It also raises broader questions about institutional autonomy and

the role and mission of community colleges vis-à-vis four-year colleges and universities.

By adhering to a statewide agreement governing the AAT, four-year institutions in the

State of Maryland have relinquished some degree of their traditional control over the

"essential freedoms" of a university, including what is taught (since there is a common

set of educational outcomes for AAT programs statewide) and who may be admitted to

study (since AAT graduates are guaranteed admission to a four-year public institution).

(See Kaplin and Lee (1995) for a discussion of these essential freedoms, which were

articulated in Supreme Court Justice Felix Frankfurter's concurring opinion in *Sweezy vs.*

New Hampshire.) Such broader social and political ramifications, while beyond the

immediate scope of this study, are important to consider in any analysis of the

environment in which educational leaders and policymakers operate.

Secondly, local and state legislators make decisions and enact polices and laws

that affect the funding, activities, and priorities of the state's entire educational system.

They are also accountable to their constituencies who pay taxes that support K-12 and

higher education. Benefit-cost analysis provides one set of lenses for studying the value

of such educational investments and their returns both to individuals and society as a

whole. The current study, for example, considers the net present value of these policy

alternatives to taxpayers by weighing both benefits (in the form of future taxes from program participants) and costs (in the form of state subsidies to higher education, financial aid to program participants, and foregone taxes during college attendance). While this economic approach to policy analysis represents a single set of inputs into decisions that are made by legislators, who must also take into account a broad range of social and political considerations, it does provide a framework for systematically comparing the outcomes of alternative courses of action, in this case in the form of relative benefits and costs. In the present study, it allows legislators and taxpayers to probe the question of which programmatic investment yields the greatest net economic benefit to the State of Maryland in its pursuit of such goals as bringing better prepared community college students into the teacher preparation pipeline, strengthening transfer rates into teacher education programs at four-year institutions, and ultimately increasing the number of high quality teacher candidates from Maryland colleges and universities who enter teaching positions in the state upon graduation and are ultimately retained in the profession.

Finally, this study holds several implications for community college students who are seeking entry into the teaching profession. Unlike many states, Maryland currently offers multiple pathways for community college students who want to pursue a degree program in education. However, differential economic benefits and costs are associated with these various options, both for students as individuals and for society as a whole. As noted in Chapter 3, prior research suggests that college students are knowledgeable about such economic factors as future earnings differentials by career field and level of educational attainment and often take these factors into consideration when making

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decisions regarding their educational pursuits (McMahon & Wagner, 1981; Paulsen, 2001a). At the same time, however, a major criticism of this economic perspective is that students do not generally have access to accurate or complete data upon which to base their decisions about investments in education (DeYoung, 1989; Dreijmanis, 1991). There is also general reluctance in the educational community to measure outcomes in monetary and economic terms, which are not seen as adequately capturing the broader social value and utility of education (Lewis, 1990). This study did not take into account other non-monetary returns to higher education which would presumably accrue to society, including Maryland taxpayers, including such returns identified by Bowen (1977) as increased consumer choice, increased civic involvement, increased capacity for adaptability in times of economic change, and increased consumption of leisure activities. As a result, Bowen (1977) suggested that traditional monetary returns in such studies be considered the "lower boundary" for actual rates of return that would more fully reflect the true benefits and costs of investments in education.

Recommendations for Future Research

This study used benefit-cost analysis to examine the economic benefits and costs of offering the AAT in the State of Maryland. As discussed in Chapter 3, benefit-cost analysis has had a wide variety of applications in previous educational research. The specific methods in this study followed Gramlich's (1990) approach for evaluating human investment programs, including education. Alternatively, the efficiency and productivity of the AAT could be examined from other perspectives using other research approaches in the future. For example, one could look at which individual Maryland community colleges produce the most AAT enrollments, graduates, transfers to four-year

institutions, and eventual bachelor's degree recipients at the least cost over a determined period of time. The creation of a panel dataset using stochastic frontier analysis, another method of economic modeling, could elicit best practices and productivity indices at the institutional level that contribute to these AAT outcomes, while incorporating additional methods such as surveys and focus groups in the development of the dataset.

Another area for further research is the continued refinement of the benefit-cost model that was used in the study for conducting other program-level analyses in higher education. Rather than considering economic returns from investments in higher education in general as many previous studies have done (Becker, 1964, 1978, 1993; Cohen & Geske, 1990; Schultz, 1963), the present study examined outcomes associated with a specific educational pathway (transferring from a community college to a four-year institution), specific academic program (elementary or secondary certification), and specific employment outcome (teaching in a Maryland public school). The extent to which benefit-cost models in higher education hold up when subjected to such high levels of specificity could be explored by replicating the study, further refining the methods and assumptions, and comparing outcomes across a range of research settings.

The corollary issue to the refinement of this benefit-cost model is the ability to gather current, accurate, and reliable data that can be used to make the various projections that are needed for this type of research. In Chapter 4, several areas were noted where precise data were either unavailable or not aggregated in a format that could be used for the purposes of the study. This necessitated the extrapolation of data from other sources and the development of a series of inferences and assumptions. Since this study followed the path of Maryland students across various educational sectors and into the workforce,

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data were drawn from a variety of sources that track this information for their respective

areas, including MHEC (all Maryland public and independent higher education

institutions, two-year and four-year), USM (four-year member public colleges and

universities), and MSDE (K-12). With the notable exception of the state's Transfer

Student System (TSS), however, data sources that track student progress through

Maryland's higher education system are not well integrated across various institutions

and sectors. These challenges raise important implications for other researchers who plan

to conduct studies of a similar nature and scope in the future. Clearly, statewide data

systems are needed that address these shortcomings in order to strengthen the state's

research agenda on student outcomes from higher education.

Over the past several years, Maryland has been planning for the development and

implementation of a statewide education Longitudinal Data System (LDS). The purpose

of such a system is to provide a greater degree of data integration in order to be able to

track students longitudinally as they progress through the K-12 school system, into higher

education, and eventually, into the labor market and workforce. As cited in the final

report of the Interagency Committee on the Development of the Maryland Longitudinal

Data System (2009), the central goal for establishing a statewide LDS is to "answer

policy and research questions that will support decision-making and will lead directly to

improvement of the education of Maryland's citizens" (p. 4). In Maryland, such data are

currently collected and maintained by separate state agencies—namely MSDE (K-12

data), MHEC (college and university data), and the Maryland Department of Labor,

Licensing, and Regulation (DLLR) (workforce data). While Maryland was unsuccessful

in obtaining American Recovery and Reinvestment Act (ARRA) funds specifically

designated for the development of a statewide education LDS, further development is being supported through Race to the Top (RTTT) federal funds, granted to the state in 2010. Also in 2010, a statewide committee was appointed by Maryland Governor Martin O'Malley, chaired by USM Chancellor William "Brit" Kirwan, to continue to move the statewide education LDS agenda forward. Research efforts such as the current AAT study, which require that students be tracked and linked across multiple institutional sectors and into the workforce, would be greatly enhanced through the availability of such a data system.

Since the AAT is a relatively new academic program that had only been in place for a few years at the time of this study, it is important that this research be replicated when longitudinal data are available. With limited data to draw upon, many of the assumptions in this study were based on community college students who were just beginning to progress through the AAT pipeline but had not yet entered a four-year institution or the teaching workforce. It is unknown whether their initial enrollment and transfer patterns will be representative of future AAT students. In addition, it is currently unknown whether the long-term employment outcomes of AAT students (i.e., their likelihood of taking a teaching job in Maryland and being retained in the field) will actually differ from those community college students who enrolled in a traditional transfer program in teacher education. It is recommended that several additional cohorts of students progress through the AAT pipeline before this study is potentially replicated in the future. In what ways will this student pipeline change over the next five to ten years, and what factors will shape these developments?

To address such issues over the long-term, the state's AAT Oversight Council

formed the AAT Continuous Review Committee in 2009, which was charged with

developing a plan for continuous review of Maryland's elementary and secondary AAT

degrees and related policies and processes. The committee, whose work is ongoing, was

asked to determine the critical elements for such a review, to identify aspects of the AAT

degree implementation process that have been problematic for students and institutions,

and to systematically identify areas of strength and weakness in the various AAT

program areas (AAT Oversight Council, 2009). The scope of this charge includes a study

of the alignment between AAT course standards and learning outcomes, the transfer and

articulation process between two-year and four-year institutions, and the AAT student

pipeline. While the primary focus of this committee's work is on the academic quality of

the AAT and its implementation at individual institutions, the current study can

complement these efforts through assessing the benefits and costs of the degree in a

broader state-level context, as well as providing three different implementation scenarios

of the AAT.

In addition to the AAT, the research framework used in this study could be

applied to other policy questions of interest in higher education, particularly in the

analysis of benefits and costs that are related to specific academic programs. For

example, this approach could be used to analyze policy developments in other states that

are exploring alternative pathways for community college involvement in teacher

education, including transfer programs similar to the AAT. It could also be used to

evaluate economic outcomes for academic programs in other areas of workforce shortage,

including nursing, engineering and other STEM disciplines, and teacher preparation

programs in targeted shortage areas. As discussed in Chapter 1, the State of Maryland approved the Associate of Science in Engineering (ASE) in 2009, which follows the general structure of the AAT as an outcomes-based, statewide articulated associate's degree program. Drawing upon the methods used in the current research study, a similar benefit-cost analysis could be conducted to examine the ASE as Maryland community college students progress through this new two-year to four-year engineering pipeline.

While this study focused specifically on select economic outcomes pertaining to the role of community colleges in teacher preparation, there are also broader issues of social and political consequence that are important to address from a research perspective. First, with respect to community colleges, this study did not consider such issues as the extent to which policy developments such as the AAT affect the traditional role and mission of community colleges, the efficiency and effectiveness of formal statewide transfer articulation agreements versus voluntary arrangements among individual institutions, and factors that either facilitate or deter the student transfer process from community colleges to four-year institutions. Second, with respect to teacher preparation programs and the teaching profession, this study did not consider such issues as the impact of alternative modes of preparation on teacher quality, perceptions of the teaching profession as a career option for college graduates, underlying reasons for supply-and-demand problems in areas of critical teacher shortage, and factors related to the turnover and retention of the current teacher workforce. While these issues were beyond the scope of this analysis, they are important to research in order to gain a more complete understanding of the broader social and political issues that shape the economic outcomes of the study.

Finally, it is important to question whether different modes of academic preparation at the community college level actually make a difference once a teacher candidate has transferred to a four-year institution, graduated with a bachelor's degree, and entered the teaching profession. Although the AAT degrees are distinct from traditional transfer programs in Maryland community colleges, are there measurable differences between the two pathways with respect to such longitudinal outcomes as readiness to transfer, academic performance at the four-year institution, likelihood of entering and staying in the teaching profession, teacher content knowledge, teaching ability, and success with fostering student learning in the classroom? Such questions are of central importance to educators and policymakers alike who are involved in efforts to increase and strengthen the pipeline of teachers who originally enter higher education through Maryland community colleges.

Summary

This dissertation considered the economic benefits and costs that were associated with three alternative policy options for Maryland community colleges in teacher preparation. The study included past, present, and hypothetical future scenarios. Benefit-cost analysis was presented as a tool to help educators, researchers, and policy-makers consider the relative economic impact of each of the three alternatives. The methodology used in this study provided a systematic framework for evaluating these educational programs from an economic perspective and for measuring the benefits and costs of such options for program participants, taxpayers, and broader society. At the same time, benefit-cost analysis represents only one of many potential approaches that could be used to study these alternatives, and as discussed in Chapter 5, further longitudinal research is

needed to assess the impact of these policy scenarios on the teacher preparation pipeline originating in Maryland community colleges.

Maryland's AAT degree represents a statewide, outcomes-based approach to higher education program articulation, as it meets the lower-level content, outcomes, and requirements of the first two years of a bachelor's degree program in teacher education. When an AAT is earned, community college students are able to transfer up to 64 credit hours to a bachelor's degree program, which satisfies all lower-division program outcomes without further review from a Maryland four-year public or independent institution. The AAT also has more stringent graduation outcomes than a typical AA degree, including a cumulative grade point average requirement of a 2.75 (on a 4.00 scale) and a passing score on the national Praxis I teacher examination. Taking these program design parameters into account, this study demonstrated economic benefits associated with optimizing the teacher preparation pipeline for students who begin their study in community college AAT programs, while it also showed potential economic costs associated with restricting this pipeline if the AAT were the sole transfer option for entry into a four-year teacher preparation program. Additional research studies are needed to see whether these findings hold up over time as the AAT degree programs mature, and to examine the extent to which the AAT influences longitudinal student progression through the two-year to four-year college pipeline and into the K-12 teaching profession in Maryland.

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