



# **Ph.D. Student Persistence & Attrition Study**

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While retention and attrition among undergraduate students has long been an issue in higher education, the issue of attrition among graduate students has received relatively little attention. The sheer number of undergraduate students has been advanced as one reason for the focus on attrition at that level (Cooke et al, 1995). Given the projected 13.4 million undergraduates enrolled in degree granting institutions in the U.S. in Fall 2002, and the fact that more than 40% of undergraduate students do not complete a degree, the sheer number of dropouts can have a significant impact on university operations (Horn et al, 2002; NCES, 2002, Tinto, 1987). And, it is proposed that the increasing diversity of this population, with a higher percentage of nontraditional students, will lead to even higher rates of attrition in the future (Choy, 2002).

Smaller numbers of graduate students relative to undergraduates, especially those seeking a doctoral degree, have made attrition among this group less important to administrators at the university level. Most interest in this topic to date has been at the college or department level (Cooke et al, 2002). Several factors have led to interest in Ph.D. student attrition at the university level at the University of Maryland Baltimore County. First, our standing as a Doctoral Research Extensive Institution in the Carnegie Classification system is dependent on producing 50 or more Ph.D. recipients each year.<sup>1</sup> Second, most graduate students receive some type of financial assistance, be it an assistantship or fellowship. Given our current economic climate, it is vital that we make the most of such investment in our students by maximizing their persistence and eventual graduation. Finally, UMBC's successful focus on diversity at the undergraduate level has extended to our graduate student population. UMBC recently received the Council of Graduate Schools (CGS) and Petersons Award for promoting inclusiveness in graduate education. In addition, a 5-year grant from the National Science Foundation from the Alliances for Graduate Education and the Professoriate (AGEP) has been awarded to UMBC to diversify our doctoral programs in science and engineering. An understanding of differences in persistence and attrition among graduate students is important for identifying areas that should be addressed in promoting diversity among our Ph.D. student population.

In the past, the Office of Institutional Research has examined retention and graduation rates for graduate level students at UMBC, but only at the university level (see Table 1). In this table, for the three cohorts considered to have ample time for the majority of students to have completed their Ph.D. experience, namely those enrolling in the Fall of 1990, 1991 and 1992, the average graduation rate of students receiving a doctoral degree after ten years was 36.3%. Nationally, graduation rates for Ph.D. students have been estimated to

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<sup>1</sup> The 2000 Carnegie Classification defines Doctoral/Research Universities—Extensive as follows: These institutions typically offer a wide range of baccalaureate programs, and they are committed to graduate education through the doctorate. During the period studied, they awarded 50 or more doctoral degrees per year across at least 15 disciplines. The Carnegie Classification schema is scheduled to change again in 2005.

fall anywhere between 30 and 70 percent (Herzig, 2002; Lovitz, 2001, Nerad and Miller, 1996). Concern over seemingly low rates of completion at UMBC led to a more detailed analysis of the data at the individual level for the fall cohorts of Ph.D. students entering the institution from 1990 to 2001. This analysis was undertaken for several reasons, namely increasing awareness and convincing departments of the problem, as well as garnering support for ways to improve retention and graduation rates.

Data were presented to the departments listing each new Ph.D. student enrolled by Fall cohort year, with his/her subsequent enrollment status and major indicated for each semester between that year and the Spring semester of 2002. Data were also presented for the student's degree history, indicating the degree, major, and the semester received. This individual level data allowed us to examine the outcome for each student, and to analyze differences between men and women, program areas, and racial/ethnic groups. Data for this report are from the Enrollment Information System from Spring 1990 through Spring 2002 and Degree Information System for FY 1990 through August 2002.

### **Methods and Findings**

Each student's history was examined to determine his/her current status as of the Spring 2002 semester and/or August 2002 graduation date. The following types of outcomes were identified:

***Dropout*** – student did not re-enroll in the program in the last two semesters and has not received a degree

***Master's and left*** – student received a Master's degree in the program and did not re-enroll in that major

***Master's and still enrolled*** – student received Master's degree in the program and is still enrolled in the program

***Master's and stopout*** – student received Master's degree in program in Fall 2001 and did not enroll in that program in Spring 2002

***Master's in last semester*** – student received Master's in Spring 2002, last semester in which enrollment was analyzed

***Ph.D.*** – student received Ph.D. in program

***Still enrolled*** – student still enrolled in program and has not received a graduate degree in that program

### **Persistence & Attrition**

The above outcomes are summarized, both university-wide and by department, in Table 2. It is important to remember when looking at these numbers, especially the totals for all the cohorts, that for many of the cohorts, the Ph.D. process has not been completed. Nationally, the average time to graduation for Ph.D. recipients is approximately 7 years (de Valero, 2001). The insert at the bottom of

Table 1 shows that the average time to graduation for Ph.D. recipients at UMBC has risen from 6.13 years in 1997 to 7.30 years in 2002.

For the three cohorts we may consider to have completed their graduate careers (1990, 1991, and 1992), an average of 35.0% of new Ph.D. students dropped out, while 39.3% earned their doctorate and 22.4% left with only a Master's degree. The remaining three percent are still enrolled. The overall graduation rate is slightly different from that presented in Table 1 because the period of time given until completion for this study is longer than the ten years examined for Table 1.

Table 3 provides an even more summarized view of the data. By major, those programs with the highest percentage of new Ph.D. students from Fall 1990, 1991 and 1992 actually receiving a doctorate by Summer 2002 include Molecular and Cell Biology (53.6%), Applied Developmental Psychology (52.4%), and Chemistry (48.1%). The program with the lowest graduation rate for comparative cohorts is Policy Sciences, with only 22.0% receiving a Ph.D. Possible reasons for some of these programmatic differences are explored later in this paper.

Also found in Table 3 is student attrition in terms of those who have dropped out without receiving a degree, be it Master's or Ph.D. We divided the programs into three categories based on total enrollments from Fall 1990 to Fall 2001. For these purposes, more recent programs and Ethnomusicology (discontinued), which had no new enrollees after 1993, have been removed from consideration.

In order to produce Ph.D. recipients, students must be enrolled and retained in a program. It follows that we should not only consider the number of students attracted to our Ph.D. programs, but also the number that we manage to keep enrolled. In terms of recruitment, the strongest programs, those enrolling **100 or more** new Ph.D. seekers, include Computer Science, Human Services Psychology, Chemistry, Electrical Engineering, and Policy Sciences. This listing also indicates the order in which these programs rank in terms of attrition, with Computer Science having the lowest percentage of dropouts at 17.1% and Policy Sciences having the highest with 39.6%.

For the second group, those enrolling **51 to 99** new Ph.D. seekers, Chemical Engineering performs the best in terms of attrition (16.4%), while Molecular & Cell Biology comes in last with 34.8% of its students dropping out. Finally, those programs with only **50 or fewer** new Ph.D. students, ranked by attrition, include Applied Statistics, Information Systems Management, Marine -Estuarine Environmental Science, Physics, and Biochemistry. With 75.8% of its new Ph.D. students dropping out and only 33 new Fall Ph.D. students between 1990 and 2001, Biochemistry has experienced the greatest student attrition at this level.

There is not a significant correlation, however, between the number of students enrolled and the dropout, or attrition, rate. So, we might assume that since it is

not the number of students recruited for a program, it could be the type of student or something that occurs during the education process that is affecting Ph.D. student retention.

### Timing of Attrition

First, let's consider the pattern or timing of attrition. Looking at all Ph.D. programs at UMBC, regardless of time of inception, we find that 363 new Ph.D. students over this twelve year time period left their major program before receiving a degree, Master's or Doctorate (Table 4). Of these students, 213 (58.7%) did so after only two semesters of study. Are these students leaving because they are not academically proficient? Or are the programs having difficulties providing the support, academic, financial and social, needed to aid these students in their progression through the Ph.D. program? We found no significant correlation between acceptance rates into the programs and dropout rates. If acceptance rates are a proxy for the quality of student, if our recruitment and admissions processes are efficiently weeding out students predicted to be unsuccessful, some factor in the first few semesters of study may be operating to affect student retention. Examination of the Student Semester Statistics for Fall 2001 and Spring 2002 compiled by the Office of Institutional Research (OIR) indicates that zero percent of doctoral level students ended the semesters with academic probation or dismissal. Binary logistic regression, performed later in this study, also revealed that GRE scores are not significantly related to the probability of dropping out of the Ph.D. program. This finding further supports the idea that attrition is not related to the quality of students recruited.

In terms of lost investment in our Ph.D. students, 21 of the students (5.8%) were enrolled for 5 years or more before dropping out of their program. Three students were actually enrolled for nine years and left without receiving a degree. In all, however, 80.7% of those leaving did so after enrolling in their program just two years or less. It may be assumed that after two years of study, much of the coursework required for the doctoral degree has been completed. This being the case, we must ask if students are leaving to pursue their degrees at other institutions, are they being academically dismissed, or are they leaving for some other reason such as lack of motivation, conflict with other responsibilities, etc. Of course our data do not indicate whether departing is voluntary or involuntary, nor do we have information regarding the future plans of those departing. Academic departments themselves may be able to provide a more detailed explanation for this leaving behavior.

### Leaving With A Master's Degree

Losing our Ph.D. students after they receive a Master's degree also appears to be a fairly significant problem. For example, in the 1991, 1992, 1996 and 1997 cohorts, approximately one quarter of the students left their program with only a Master's degree. For more recent cohorts, e.g. 1998 and 1999, more than ten

percent had left with only a Master's degree by Spring 2002. Examining the Fall 2002 enrollments of the 15 students in these two cohorts receiving a Master's degree in the Spring or Summer of 2002, we found that one-fifth of them had not re-enrolled. While some educators might consider this type of attrition as a success (since the student is leaving with a degree), it counts as a failure to achieve the Ph.D. at UMBC, the ultimate goal of both the university and the student upon his/her entry into the program.

### Student Characteristics & Attrition

Is there something unique about the characteristics of students who depart before completing the Ph.D. requirements? Overall, 1271 new Ph.D. students enrolled in UMBC in the fall semesters between 1990 and 2001. Characteristics of these students can be found in Table 5. Detailed information about the gender and racial distributions by academic program are available in Tables 6 and 7, respectively. Table 5 shows that 46.6% of Ph.D. students in these cohorts are female. This figure appears consistent with national numbers, with 44% of Ph.D. recipients in the U.S. in 2001 being female (Hoffer et al, 2002). UMBC appears to have a higher than average percent of international doctoral students (40.5%) compared to the national average (24% of 2001 recipients were internationals) (Hoffer et al, 2002). This relatively high number of international students is likely due to UMBC's concentration in Science and Engineering programs, which tend to attract and enroll higher proportions of international students. In engineering programs alone, 73.2% of the students are international (Table 7). And, according to the 2001 Survey of Earned Doctorates, 50.4% of the engineering Ph.D.'s awarded in 2001 went to international students, indicating that UMBC has a higher proportion of international students than the average institution, even in those disciplines where international students tend to be over-represented (Hoffer et al, 2002).

What, if any, student characteristics are associated with Ph.D. student attrition? Three series of explanatory models were estimated, each using three outcome variables. We used Binary Logistic Regression Analysis to determine those factors associated with dropping out of the program without any degree (1), leaving the program with a Master's degree only (2), and leaving the program with or without a Master's degree (3). Results discussed here are summarized in Table 8. Covariates entered into the first series of models, Analysis 1, include age, gender, international status, being in a Science & Engineering area program, and full-time/part-time status. For the first model, controlling for the other covariates, being a Science & Engineering major significantly increased the likelihood of dropping out by 54.6%. Likewise, being a part-time student and being older also increased the likelihood of dropping out, by 61.1% and 2.4% respectively, while being a international student decreased the likelihood by 34.6%.

For the second model, predicting the likelihood of leaving with only a Master's degree and controlling for the other covariates, being a Science & Engineering major increased the likelihood of leaving by 127.6%. Here, being an international student had the opposite effect from in the previous model, increasing the likelihood of leaving by 47.6%. The interaction of age also has an opposite effect in this model-- being older decreased the likelihood of leaving with just a Master's degree by 7.3%. In this model, gender was found to be significant as being female increased the likelihood of leaving with only a Master's degree by 29.1%.

The third model in this series examines the factors related to departing without a Ph.D. whether or not a Master's degree was earned. For this model, controlling for the five covariates, only full-time/part-time status and being a Science & Engineering major were statistically significant. In this model, being a part-time student significantly increased the likelihood of leaving by 69.4%. Being a Science & Engineering student is again strongly related to leaving, as being this type of student increased the likelihood of leaving by 108.7%.

In the second series of models, the factor of being an African-American student was added to the group of factors included in the regression analyses. Given the small number (n=6) of African-American students leaving with a master's degree, only the results of the first model (those who left without earning any graduate degree) are presented. As seen in Table 8, when controlling for the other factors, being a Science & engineering major increased the likelihood of leaving without a degree by 58.6%. While being international decreased the likelihood of leaving, being an African-American student increased the likelihood of leaving by 60.5%, controlling for the other factors. As in the first series, being a part-time student was still found to increase the likelihood of leaving by somewhat more than 60%.

Concern over the effects of financial burden on graduate students led us to introduce duration of assistantship support into the third and final series of models. This variable is based on a count of the number of semesters a student received assistantship support, not accounting for the type of assistantship. Being a minority student<sup>2</sup> was also included as a factor in this series of models. As seen in Table 8, the longer the length of assistantship support, the lower the likelihood of leaving without any degree, with only a master's degree, or with or without a master's degree. The effect appears to be stronger, however, when looking at those students leaving without any degree at all. Even accounting for the length of assistantship, the strongest factors associated with departing without a Ph.D. remain being a Science and Engineering major and being a part-time student. And, while being international increases the likelihood of leaving with only a masters degree, it is associated with a decreased likelihood of leaving without a degree at all.

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<sup>2</sup> Minority students are defined as those indicating race/ethnicity to be Hispanic, Asian American, African American, and American Indian.

## Where They Go

When Ph.D. students leave UMBC, either with or without a Master's degree, where do they go? Do they leave academia entirely or are they enrolling at other institutions? To try to answer this question, we submitted data for the 546 students who left with either no degree or a Master's to the National Student Clearinghouse (NSC). This Clearinghouse is a non-profit association that maintains a comprehensive electronic registry of student enrollment, degree, and loan data. Over 2,700 colleges, representing 91% of the nation's enrollment, participate in the Clearinghouse by providing regular student record updates on all of their currently enrolled students. Of the 546 students from UMBC, 346 were traceable through the Clearinghouse, but 170 had no record of re-enrollment at another institution registered with NSC. Of the 176 that had records, 20 were blocked (i.e., the student and/or the receiving institution indicated that data should not be released).

Those institutions with the highest number of "transfers" from UMBC were College Park (17), Johns Hopkins (15), University of Baltimore (6), Towson (6), and the University of Connecticut (5). Other notable institutions with 4 or fewer "transfers" include the University of Michigan, Rutgers, Carnegie Mellon, Penn State, UC Berkeley, and Virginia Tech. The NSC data do not allow us to determine at what level these former UMBC graduate students were enrolled at these institutions.

## Conclusions

One of UMBC's goals is to graduate at least 50 Ph.D. recipients annually. The question is, how do we maintain or increase this number? Do we recruit more students into our programs, put more effort into providing the necessary environment to foster success among our Ph.D. seekers, or both? Barbara Lovitts, in her book "Leaving the Ivory Tower", reports that nationwide, Ph.D. programs graduate their students at a rate of approximately 50%. Other estimates range from 30% to 70% (Herzig, 2002; Nerad and Miller, 1996). Nerad and Miller (1996), in their study of the 1981-83 cohort of Ph.D. students at the University of California, Berkeley, found that 78% of the students completed a graduate program, with 60% receiving a Ph.D. and 18% leaving with a Master's degree. UMBC's overall 10-year Ph.D. graduation rate of 36.3% indicates a need to focus more on keeping our students enrolled and successfully progressing towards a Ph.D. degree. Greater recruitment efforts may benefit some programs (those with higher graduation rates) than others, but all programs could benefit by improving their retention efforts.

Analysis of the characteristics associated with leaving behavior indicates several areas that may warrant attention, specifically Science & Engineering programs and our part-time graduate student population. In comparison, Nerad and Miller (1996) found the highest completion rates among the biological and physical sciences (73%), followed by 66% of engineering students. These findings appear to merit further investigation into the characteristics of students in the Science and Engineering areas, as well as the programs themselves. Nerad and Miller (1996) also found that international students had the highest completion rates in all fields and all cohorts. Given the high number of international students at UMBC, this should be a finding that we could capitalize on in generating higher rates of persistence and graduation. The challenge will be implementing changes that foster high graduation rates among international students, while also increasing the rates among domestic students.

Cooke and her colleagues (1995) suggest that affective commitment, or a sense of belonging to the university community, is critical in engendering persistence among graduate students. Findings from the UMBC Graduate Student Satisfaction Survey conducted in Spring 2000 suggest that these students do not feel such affective commitment to UMBC, with only 28.0% agreeing that there is a strong sense of community, and only 28.4% indicating that they feel as if they are an important part of the campus community. In addition, only 13.7% indicated that they felt a sense of camaraderie among graduate students campus-wide, although 62.8% did report such a sense among the graduate students in their department. At the university level, then, the issue of strengthening graduate students' commitment to the institution might be addressed.

Nerad and Miller (1996) suggest a three-pronged approach to increasing doctoral student retention. The first part focuses on institutional policies and strategies, such as more closely monitoring persistence and completion rates to identify areas of concern, as well as having a first year evaluation of each student's progress with a team of faculty. The second prong of their approach involves working with departments. Each student should have an adviser to assess his/her progress through the program and a mentor to help set goals and develop skills. Mentoring should also take place at the department level through seminars and workshops, in addition to individual faculty mentors. The third and final prong focuses on students and ways to help them strategize their way through the doctoral education experience. Suggested ways to do this include orientation programs, grant proposal-writing workshops, dissertation writing-workshops, and interdisciplinary research retreats to ameliorate the sense of isolation from students and faculty in other departments.

As Lovitts (1996) points out in her book, the cost of doctoral student attrition is felt in many areas. Faculty and departments lose the time and resources invested in students who leave. Programs with high attrition rates risk being

eliminated. The university also incurs costs in that it is cheaper to retain students than to recruit and train students who consequently leave. There are costs to society – namely the loss of the knowledge and talent that noncompleters could impart. Finally, there are the costs to the individual – financial, professional, and personal. This study has identified several groups bearing the brunt of these costs, and points to areas to focus on in our efforts to improve doctoral education at UMBC.

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