Professional Mentoring Program through Virtual Media: Challenges and Impact

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Abstract— The Professional Science Master’s (PSM) Biotechnology program at the University of Maryland University College (UMUC) has developed a novel online mentoring program with the goal to bridge the gap between the industry and academia while supporting the academic efforts of diverse students. In this mentoring community, industry professionals serving as mentors are paired with new students entering the graduate degree program. The students interact and seek advice from the mentors as they progress with their degree. Preliminary data from the pilot suggest that the participating students successfully completed all their classes and the overall experience by both mentors and mentees was positive and meaningful. The future of the program and its potential impact on student performance will be discussed.

Index Terms— Biotechnology, evaluation, industry, mentoring, professional action plan.

I. UMUC AND PSM PROGRAMS

The Professional Science Master’s (PSM) programs conceived in 1997 are aimed at training people in skills that are more suited for a professional/managerial position in the non-academic sector [1]. Currently, there are 170 PSM programs at 86 colleges in 25 states nationwide. The uniqueness of PSM degree program is inherent in its interdisciplinary nature, i.e. in addition to a majority science content, it includes skills based courses that allows the student to attain not only science knowledge but also other skills that are highly desirable in the workplace. In addition it places a strong emphasis on the integration of a professional skills component, developed in collaboration with the industry, into the curriculum.

University of Maryland University College (UMUC) is one of 11 degree granting institutions in the University System of Maryland. Addressing the needs of mostly working professionals, it offers 14 master’s degree programs, most of them in an online format [2]. It is the only university nationwide that offers 5 online PSM programs[3]. In all 5 PSM programs the professional skills component is offered to the students in the form of a semester long “virtual Internship,” where students work in teams to complete a project sponsored by a company.

II. INDUSTRY-ACADEME PARTNERSHIP

The need for collaborations between the industry and academic institutions to enhance student learning and professional development is well recognized, and initiatives are being undertaken nationwide to establish a variety of relationships which may vary in scope, objectives and goals based on the partners. The most common types of collaborative partnerships include the presence of industry professionals on departmental advisory boards, product usage where universities receive discounted software from companies such as Oracle and Microsoft to be integrated into the curriculum [4], and companies providing real-world capstone projects for students [5]. Another type of partnership involves forming an industry-academia consortium [6]. The consortium is formed by a university and several industry partners, with each industry partner providing a different service or product.

The PSM Biotechnology program at UMUC addresses the need for an industry partnership through the capstone course, the final course in the program, where students work in teams to complete a project for a company [7]. This relationship, although beneficial to both parties and rewarding for students, lasts only one semester.

In recognition of the need for academic-industry partnerships to enhance student learning and professional development, the National Science Foundation (NSF) has allocated funds for programs that foster industry academia partnerships. One such example is The Advanced Technological Education Program which has a component of mentoring in its partnerships [8].

III. MENTORING OF STUDENTS

Although PSM programs promote a strong and close relationship between academic institutions and the private sector, a gap still remains. One strategy that could help bridge this gap is fostering mentoring interactions between industry professionals and students.

Mentoring programs have been in existence for decades and there are empirical studies indicating that they enhance student learning. Research indicates that mentoring has a positive impact on the personal and professional development of students [9].

There is also a growing body of research in higher education that suggests an empirical link between student mentoring and student retention [10-11]. For instance, Ref. [12] used an experimental research design in which students were randomly assigned to either an experimental group which received mentoring, or a control group which did not. It was found that students who received mentoring evinced higher retention rates than non-mentored students with similar pre-enrollment
characteristics. Effectiveness of mentoring has also been studied through meta-analysis of literature. In one study focused on corporate mentoring programs, the effect size of mentoring on career outcomes was found to be significant [13]. Yet another study, comparing mentored and non-mentored students across disciplines, found that although there is some association between mentoring and a wide-range of attitudinal changes including careers, the effect size was small [14].

IV. BIOTECHNOLOGY PROFESSIONAL MENTORING PROGRAM

A. Mentoring Model at UMUC

Since all UMUC programs are online and its student body geographically dispersed, in response to a grant proposal it was proposed to develop a mentoring program to bring the industry and academia together in a virtual environment. That led to the development of a web-based professional mentoring program with the overarching goal to bring the industry and academia closer together to enhance the learning experience and marketability of our diverse student population. The specific objectives of the mentoring program are to 1) Increase awareness of workforce needs among students; 2) Identify students’ professional goals; 3) Improve the university’s interaction with the industry/government; 4) Provide opportunities for students to find the “best fit” jobs upon graduation. This online mentoring program offers some key features to the master’s students in the biotechnology program: 1) It provides industry guidance to the student from the onset of the program by pairing each selected student with professionals from the industry, 2) It is embedded in the degree program, 3) It is offered at graduate level, 4) It utilizes Web-based technologies that enable easy access and participation, provide flexibility and easier management of resources, 5) It runs in parallel with and the length of the student’s degree program.

B. Mentoring Program Development

The design and development of the mentoring model and platform took about a year. The process started by assembling an Advisory Board who advised on the requirements for a mentoring platform to be used for interaction between the mentors, mentees and mentor assistants. An exhaustive research on existing open-source software that could work as a platform for the mentoring interaction was conducted. A learning management system called Claroline was identified as the best fit for our needs. The platform [15] was customized to have two areas: the public section provides information on the mentoring program, the major stakeholders and the roles, responsibilities and benefits to each of them. Also available in this part are the application forms for both mentors and mentees, the complete grant proposal, links to the UMUC website and its PSM programs, as well as bios of the Advisory Board members and mentor affiliations. The private area, which requires login, is set up as classrooms for each mentor-mentee pair, so that they are able to interact and share documents, chat, send emails or have audio/video conferencing with each other.

To assess its user-friendliness, usability testing was conducted on the platform with people who were completely unfamiliar with the tool. One-half of the users were asked to explore the site as students and the other half to play the role of mentors. The results from this study identified certain sections in the public area that were ambiguous, such as the project description, lack of clear student selection criteria, and redundancy of information. The private area was found to be non-intuitive in places. The recommendations were implemented by incorporating the suggested changes in the public area and by hiding and renaming the confusing sections in the private area. Also, as a result of one of the usability testing recommendations, training material to navigate the site was developed.

Considerable time was devoted to the creation of various documents including marketing materials for advertising the program and recruiting mentors, application forms for the mentor, the mentored-student and the mentor-assistant, and end-of-semester evaluations forms for the participants.

C. Mentoring Process

There are four key players/stakeholders in this program: 1) Mentees who are students in the biotechnology program; 2) Mentors who are professionals in the industry, academia, government or non-profit organizations; 3) Mentor assistants (MA) and Mentor assistants lead (MAL) who are graduates of the biotechnology program and the liaisons between mentors and mentees. In addition to the MA duties, the MAL also supervises the logistics of the entire process.

The mentoring process starts with new students being asked to apply for the program. The applications are screened by the MAs, the MAL and the project director according to certain selection criteria, such as writing skill, clear articulation of reasons why they are pursuing their degree of interest, and justification for what makes them a good candidate for the program. Grades and academic performance are not part of the selection criteria. Based on the area or specialization of interest, students are paired with mentors. The MAs organize orientation sessions for the mentors and the mentees during which the expectations and requirements of the program are discussed. Each mentor-mentee pair is assigned an MA who introduces the pair to each other and assists them in developing a healthy, professional relationship.

In preparation for the first meeting, the mentee completes a professional action plan that outlines his/her short and long term goals along with the action items for achieving each goal. The mentor provides comments and suggestions on this action plan, and the two agree to follow up during the semester. The mentees have to post the minutes of each meeting so that there is a record for each pair’s interactions. One MA is assigned to several mentor/mentee pairs and it is his/her responsibility to ensure that each pair is meeting regularly, with a minimum of once a month. If the participants have any questions about their roles and responsibilities or if they are not getting the response they expect, the first point of contact is the MA, who will clarify or resolve issues as they arise. The MAL has fewer mentor-mentee pairs to work with but is responsible for all the MAs taking care of their pairs’ needs diligently.
One of the key requirements for any grant funded project is its sustainability after the grant period. Shown in Fig. 1, is our proposed model for how the mentoring program will become self-sustaining. At the beginning of the program mentors will primarily come from the industry and other organizations, and some from the alumni of the biotechnology program. Students who go through the mentoring program will graduate and hopefully become a Mentor or Mentor Assistant. With time the mentor pool will include several graduates of the program.

V. EVALUATION AND PRELIMINARY RESULTS FROM THE PILOT

An important part of any project is to determine if it is making a difference. To assess if the mentoring program is impacting student learning outcomes, we will be evaluating the mentoring program and the student’s performance in the degree program to look for a correlation, if any. Measures that we will use include collecting institutional data such as demographics, time to degree completion, GPA, course completion rate, as well as end of semester assessments completed by both mentors and mentees.

A. Mentoring Program Pilot Data

At the fall 2009 launch of the pilot program, 30 students and 24 mentors applied to participate. We started the program with 19 pairs. Of the 19 mentors 14 were from the private sector, 2 from the government, one from the academia, and one was self-employed. Based on their professional background, the mentors fit under the degree program specializations as follows (Table I): 14 mentors for biotechnology management (BM), 2 for bioinformatics (BIN), and 3 for biosecurity-biodefense (BS). Among the mentees, there were equal number of students from the BM and BIN specializations (9 students), and one student from the BS specialization. Since there was no perfect match between the students’ and the mentors’ specializations of interest, not all bioinformatics students got a mentor with direct experience in this specialization. Also, we had many more male than female mentors but more female than male mentees. Among the student participants, 7 of them started their degree program in Fall 2009 (new students), three in summer 2009, four in spring 2009, four in fall 2008, and one in summer 2008.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Gender</th>
<th>Area of Specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentors</td>
<td>15</td>
<td>14 BM 2 BIN 3 BS</td>
</tr>
<tr>
<td>Mentees</td>
<td>8</td>
<td>11 BM 9 BIN 9 BS</td>
</tr>
</tbody>
</table>

![Figure 1. Sustainability model for the Mentoring Program](Image)

B. Institutional Data

At the end of the first semester of interaction, we looked at the performance and course completion of participants vs. non-participants who joined their degree program between fall 2008 and fall 2009. Overall, the mentoring program participants performed better in the Fall 09 semester than the rest of the students. Their grade distribution (Figure 2) shows that none of these students failed a class or withdrew from a class. This is also reflected in the comparison between completion rates for program participants vs. non-participants, for courses taken in fall 2009 (Table II). The completion rate was 100% for the participants (i.e. they successfully completed all the courses for which they registered). In contrast, the course completion rate for non-participants who registered for at least one course was 79%. 75% of these students successfully completed all their courses (i.e. 100% completion rate), whereas 14% did not complete any of their courses (i.e. 0% completion rate). Finally the participants have a higher average GPA (3.42) for the fall semester than the rest of the students (3.27).

Although we cannot claim that participation in the mentoring program is the cause of the participants’ superior performance, there appears to be a correlation between the two. This could be partly due to the fact that students who would apply to such a program are likely to be dedicated to their studies and eager to use all available resources, such as the mentoring relationship, in order to succeed.

![Figure 2. Grade distribution: percent of classes per grade for Fall 2009.](Image)
VI. CHANGES TO THE ORIGINAL MODEL

Before the program was rolled out, some changes were made in the student application and selection process; the program was opened to more senior students rather than only new students, and a new position, MAL, was created to manage the entire process of selection, pairing and interaction.

After the first semester of implementation, several more changes were made: First, an interview was added as part of the student selection process.

Second, after reviewing the comments and suggestions of the participants on the end-of-semester evaluation forms we noted that several responses were common among them. E.g., several students stated that their mentors provided networking opportunities. These common responses were incorporated as a set of statements in the new, modified questionnaire. The participants will be asked to indicate their level of agreement with these statements on a sliding scale, such as the one used by Ref. [16]: Strongly Disagree; Disagree; Slightly Disagree; Slightly Agree; Agree; Strongly Agree. The new questionnaire will be administered at the end of the spring semester.

Third, it became clear that the participants wanted more direction and clarification of the program goals. In response to this request, a more comprehensive orientation session was developed to address issues that came up in the first semester of implementation. A new mentee and continuing mentee orientation session were developed. The format of the mentor orientation was modified to place emphasis on the expectations rather than the mentoring platform. For example, it is clarified that mentors are not expected to give guidance and information that relate exactly to their specific job description, but rather a more comprehensive view of the industry the student is interested in, and so they may be paired with students whose desired career path is not identical to the mentor’s career path.

Fourth, in response to concerns expressed by two students about their pairing, mentors were re-assigned.

VII. CHALLENGES

Some of the challenges we faced for the pilot were in recruiting mentors and students. It took a lot of networking with industry organizations and use of social media tools to draw mentors to the program. Substantial time and effort was needed to promote and market the program to various organizations and companies in the area as well as in other states, to get industry acceptance of the program. The surprising and most unexpected difficulty was in getting students to apply to the program. It took repeated reminders to get a sufficient number of applicants. Yet another area that we have to work on is to document issues, discuss them and to implement recommendations before the next round. Ensuring that the mentoring relationship grows and strengthens requires close monitoring of each pair by the mentor assistants. In some cases the mentee has to be reminded repeatedly to set up a meeting with the mentor and to post the meeting minutes. This continues to be a challenge as regular interaction is an important factor in the success of the program.

C. End of Semester Evaluations Data

The end of semester evaluation forms revealed overall satisfaction by the participants and offered several suggestions for improvement. The total number of contacts between students and mentors varied from 2 to 12 (median = 5), mostly over email. Only one pair had all their contacts through phone and 5 pairs had all their contacts through email. Two of the 19 pairs noted that they used the chat-room provided on the platform. When asked what they like best about their relationship, the students mentioned how easy and comfortable it is to talk with their mentor, the interest the mentor takes to help them with their questions and goals, and the actual feedback and insight they provide, including networking opportunities. When asked the same question, the mentors mentioned sharing experiences, perspective, and aspirations; passing their insight; the enthusiasm of the students, their willingness to learn, and “intense thirst” to utilize the career guidance provided.

When mentors were asked what they did or what they would suggest should be done to enhance the online relationship, several mentioned that they shared relevant websites and articles with the student, or they referred the student to others who may have answers to their questions.

The majority of mentors and mentees agreed that the mentoring relationship has a positive effect on the student’s academic and/or professional growth (Fig. 3). When asked to elaborate, the students noted the guidance in clarifying their short term and long term goals, help in networking, and information on their field of interest. Most mentors also found this relationship beneficial to their own professional development.

Although this is an online program, 3 participants indicated that they would value f2f meetings. It should be noted that the platform provides the opportunity for live chats, but only two pairs used this feature. Two of the mentors were concerned as to whether they provide the necessary guidance, but the corresponding students expressed satisfaction. Two other students indicated they would have liked to be paired with someone who had more experience in their field of interest.

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### Table II:

<table>
<thead>
<tr>
<th>Course Completion in Fall 2009 by Mentoring Program Participants and Non-Participants.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students taking courses in Fall 09</td>
</tr>
<tr>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Participants (N=19)</td>
</tr>
<tr>
<td>Non participants (N=175)</td>
</tr>
</tbody>
</table>

Figure 3. Participants’ responses to the statement: The mentoring relationship is positively contributing to the student's academic and/or professional growth.
VIII. FUTURE PLANS

As we move forward with the second year of the mentoring program implementation, our focus is on creating a pool of at least 100 mentors and drawing many more alumni of the degree program to become mentors. In the spring semester, we started with 37 pairs of mentors-mentees and 5 MAs. 6 of the mentors are alumni of the UMUC Biotechnology program. We are developing a strategy to increase student enrollment. This will include, opening the program to students who have completed up to 12 credit hours in the degree program and finding “mentee ambassadors” who will share their experience with students in their class. Another area of focus is to improve and enhance the process of pairing a mentor with a mentee and to improve the platform features so that the pairs feel comfortable to use it for all their interactions. In the long term, we plan to follow the student’s career path as a result of going through this novel mentoring program. Finally, a strong emphasis will be placed on disseminating the program and getting other institutions as well as other degree programs within our institution to adopt and adapt it to their students.

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[15] PSM Mentoring Site: http://psmentoring.umuc.edu/

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