

DOUBLE MAJORING IN MATHEMATICS

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Whenever I tell someone that I am a double major in Math and French, they are always very surprised by this unusual combination. For many, it is difficult to see how or why this pairing of disciplines would benefit me. At first glance, a double major in two very different subject areas does not appear to be very advantageous. When undergraduates consider the option of double majoring, they normally choose two majors that could potentially complement each other. It is widely believed that by choosing complementary majors, one will have more of an advantage over single-major graduates in a particular field. Despite this widespread assumption, there has been very little evidence to support this claim. In fact, while researching the effects of double majoring with Math, I discovered that there has been minimal analysis on the potential advantages or disadvantages of double majoring in general.

Surprisingly enough, very few colleges and universities have shown any interest in analyzing the effects of double majoring. Despite being “perhaps the most significant trend in the curricular lives of students in the last decade,” there have only been a handful of surveys and studies on double majoring administered in the United States [1]. Indeed, the choice to double major has been on the rise in recent years. With an economy that has undergone many

changes and a workforce that is constantly creating new jobs, college students must adapt and become as qualified as possible for their career choice [6]. For many, the obvious road to success in this highly competitive and growing world is to be skilled and have knowledge in a multitude of subject areas. Recent studies have shown that the number of students who are double majoring is on the rise, where numbers have “swelled to more than 30 to 40 percent” at predominantly elite schools [6]. Despite this growing trend, colleges and universities have only recently considered analyzing students’ reasons for double majoring and the effect this decision has had on them.

With this knowledge, I was interested in how Hood College compared to this recent upward trend in double majoring. In particular, I wanted to see how many Math majors at Hood College decided to double major, and whether or not they chose to double major in another hard science that could potentially complement their Math major, or if they decided to take advantage of their liberal arts education and choose a more “soft” second major. As a double major approaching graduation, I was also very much interested in these Hood graduates’ lives after college. Did they choose to go on to graduate school or immediately join the workforce? Were they able to utilize knowledge and skills from both majors or did they seem to rely

on only one? Did they find that double majoring allowed them to be better prepared for life after college? With a great deal of help from the Registrar who kindly provided me with the necessary data on Math double majors at Hood and the graduates who responded to all my questions, I was able to analyze and compare my data with that of the few other “elite” schools who have conducted research on the impact of double majoring.

Hood College’s Registrar was able to provide me with graduation records from 1973-2012. I was given a list of the past 101 Hood College graduates who double majored with Math. From this information I was able to evaluate the distribution of Math double majors’ choice in second major. Using these data, I generated a bar graph so that I could inspect the most popular choices of second majors among Math majors at Hood College. After creating my bar graph I was able to observe the trends in Math double majors. My findings are the following:

From this graph we can easily see that the majority of Math double majors (about 35%) chose to pair their major with Information and Computer Science. Other popular pairings that we can decipher from this bar graph are Chemistry (at about 14%), Economics (at about 10%), Management (at about 9%), and Psychology (at about 6%) [3].

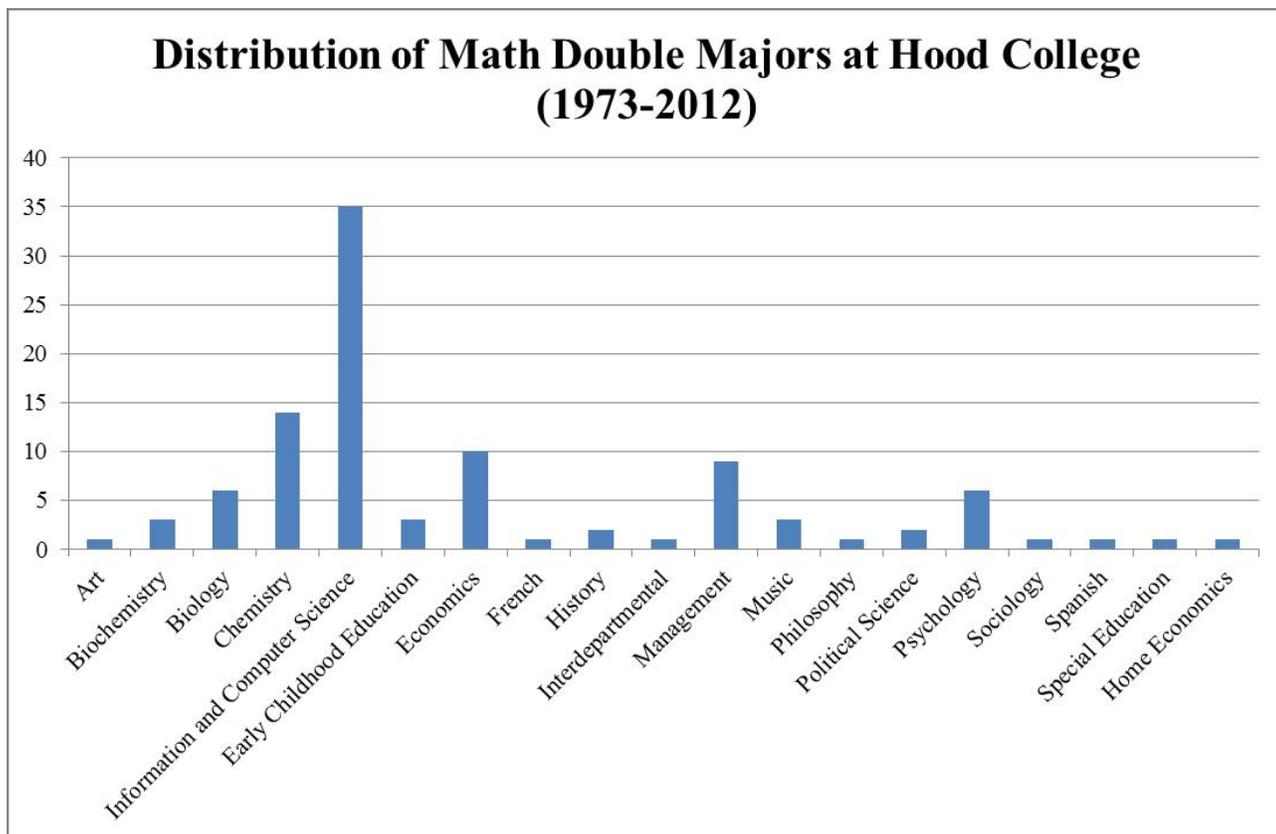


Figure 1: Math Double Majors at Hood

Just looking at this graph on its own does not provide the necessary insight into *why* Math majors tended to choose Information and Computer Science or Chemistry to pair with their Math major. It is important to note that the Information and Computer Science major no longer exists at Hood College. This major, which was available from 1982 to 1992 was part of

the Department of Mathematics. Students were required to take 30 credits in Math, Computer Programming, and Management classes and could choose between 3 different concentrations (CS Concentration, Information Management Concentration, or Language Concentration) with an additional 18 credits. Due to the overlap of Math courses, it is evident why so many Hood students decided to pursue an Information and Computer Science major in addition to their Math major. With the removal of this particular major in 1992 and the installation of the Computer Science Major and the Computational Science Major (B.S.), there is a noticeable decline in Computer Science and Math double majors because this would require students to pursue a double degree with an additional 30 credits. Knowing this, it is still important to notice this trend in Computer Science and Math double majors.

After analyzing this graph, we should immediately wonder what these second majors have in common with one another. How can one compare and contrast disciplines like Math and Psychology that may not necessarily have overlapping courses? In 1973, Professor Anthony Biglan developed a classification system for college-level disciplines. This system, later defined as the Biglan Classification, was created due to a high demand from multiple

universities and private liberal arts colleges. The Biglan Classification has, for almost 40 years, provided higher education with “a major conceptual frame-work” for academia [7]. Biglan broke down his disciplinary classification into three dimensions: paradigmatic or pre-paradigmatic (hard versus soft disciplines), the extent of the subject matter (pure versus applied), and a subject’s involvement with living matter (life versus nonlife) [2].

Biglan differentiated “hard” disciplines from “soft” disciplines by defining a “hard” area of study as those that “possess more clearly delineated paradigms” like Chemistry or Mathematics. The “soft” disciplines, like the humanities, fall on the opposite end of the spectrum. An “applied” discipline differs from a “pure” discipline if it appears to have some sort of “practical” application, like Education or Engineering. Disciplines like History or Philosophy that have less of a “practical” application are categorized as “pure” subject areas. Finally, Biglan made a third distinction between disciplines in the dimension of “life” versus “non-life” systems. Those that had an organic component, like Computer Science or Languages were considered life systems, and those that lacked that organic component were non-life systems [7].

For my purposes, I will only focus on the first two dimensions of Biglan’s

classification. From these two components, I was able to group these disciplines in a much more specific manner. I based my groupings on those done by one of the few studies conducted on the effects of double-majoring: Dr. Steven A. Tepper and Dr. Richard N. Pitt's "Double Majors: Influences, Identities, & Impacts" [8]. In the Vanderbilt University professors' report, they broke down Biglan's classification into four majors groups: the hard-pure, the soft-pure, the hard-applied, and the soft-applied disciplines. Tepper and Pitt define hard-pure as those that "emphasize universals and simplification" and are "based on logic and facts." Those majors defined as "soft-pure" use "holistic analysis" and tend to be more creative and expressive. The hard-applied disciplines (like Engineering and Computer Science) are very problem-solving oriented and the soft-applied disciplines (like Education and Music) have a strong focus on "personal growth" and "lifelong learning."

Of the 19 different second majors that Math majors chose at Hood College, I sorted them into the four groups originally developed by Biglan and later narrowed down by Tepper and Pitt. I placed Biology, Chemistry, and Biochemistry under the hard-pure category, Economics, Philosophy, Psychology, Sociology, History, Political Science, Management, and Home Economics

under soft-pure, Computer Science under hard-applied, and Art, Education, Special Education, Music, French, Spanish, and Interdepartmental under soft-applied. After sorting Hood's majors, I was able to compile my data and observe the distribution of Math double majors based on the Biglan Classification:

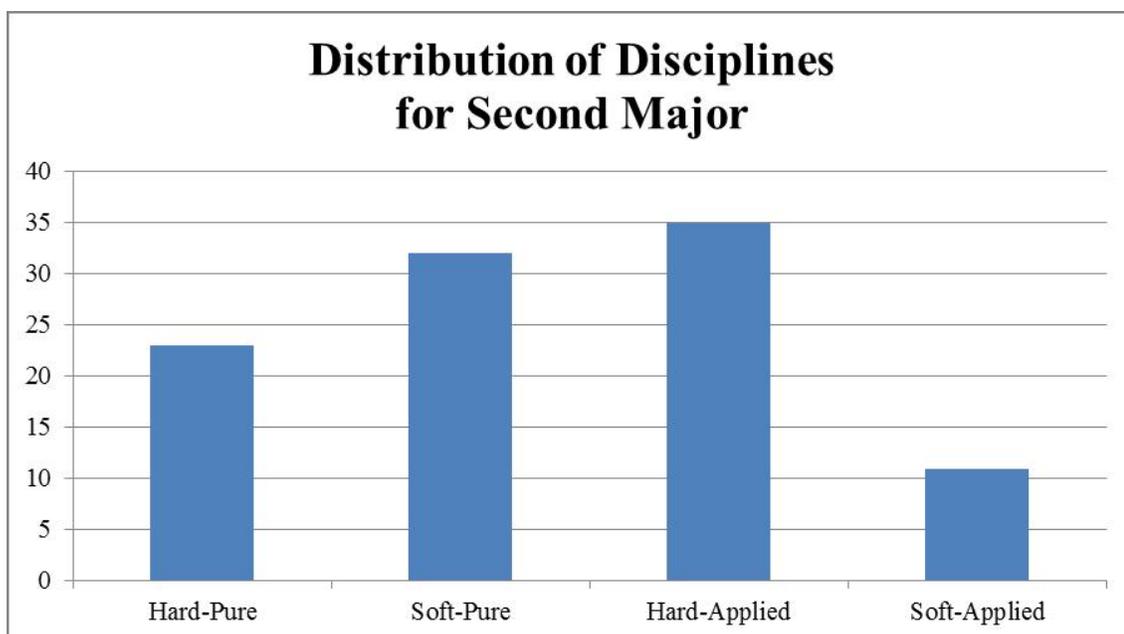


Figure 2: Based on Biglan's Classification of Disciplines

As we can see from the graph, the distribution is spread fairly evenly over hard-pure, soft-pure, and hard-applied, with hard-applied as the most popular choice at 35%. This, of course, makes perfect sense based on our

earlier data on percentage of Math and Computer Science double majors. But one interesting remark is that the percentage of soft-applied Math double majors is just shy (at about 32%) of the hard-applied ones. In Tepper and Pitt's study, they define students who venture out and double major across different disciplinary boundaries as "hypo" double majors, or "spanners." Those whose second major is in the same disciplinary area are known as "hyper" double majors, or "deepeners." According to Tepper and Pitt's findings, one-third of double majors in their survey fell under the classification of "deepeners." Additionally, they found that only 10% of the double majors were true "Renaissance" students: those who "majored in one natural or physical science and one arts or humanities discipline, allowing them to bridge the furthest intellectual distance" [1]. Hood College's data of Math double majors appears to coincide with Tepper's as far as the "super hypo spanner" or "Renaissance" figures concern (compared to 11%). In regards to the percentage of deepeners and spanners, there are some noticeable differences. Based on the data, "deepener" Math double majors make up about 57% with the "spanners" making up the other 43%. This is a much better split than Tepper and Pitt's findings.

I was curious as to why the results from Hood College showed a more even

split between the “spanners” and “deepeners” than other colleges. I was also interested in *why* these Math majors chose their second major (especially if their second major spanned over into a completely different discipline. I was able to survey a few recent Hood graduates and get an insight into this occurrence. I approached these graduates with the following set of questions:

- What made you decide to double major?
- Why did you choose your other major?
- Did you feel that your non-Math major complemented your Math major?
- Did you see any benefits in combining your Math major with your other major?
- If you went on to graduate school, did you pursue your interest in Math or your interest in your non-Math major?
- If you immediately went into the workforce, did you use your Math major or non-Math major or both?
- Do you feel that double-majoring opened doors for more career options?

Among the graduates that I interviewed, 60% graduated with a soft-applied second major and the other 40% graduated with a hard-applied second major. The responses that I received varied from person to person and especially between the two Biglan groups. The responses I received from the “spanner” graduates had very different reasons for their “soft” second major. Reasons behind the choice varied from general interest and love of the softer discipline to an initial interest in teaching a softer discipline after college. Among the “soft-applied” Math double majors, I received different opinions about the benefit of their second major. For some, their softer major allowed them to “think critically” and “be a big-picture person.” For others, their softer major was more of a “luxury major” that gave them a mental break from the rigors of the Math program. For the majority of the soft-applied Math double majors, however, their Math major was definitely the more practical of the two and would ultimately help them to be financially stable in the workforce. More often than not, it appeared that the “soft-applied” Math double majors did not believe that their two majors directly complemented each other, but they enjoyed the fact that they could develop certain skills in their soft major that they may not have used in their Math major.

The other 40% of Math double majors who chose an additional “hard”

major had very different responses to my questions. Most of the time, the “hard” discipline they chose had some overlap with their Math major. Like those students with a “soft” second major, they were able to apply skills from both disciplines, but for the “hard” double major students, this “cross-pollination” was much more obvious and direct. This overlap of courses and skills between their two “hard” disciplines created a much more complementary double-major experience for them. Despite this, only about half of those students actually used their combined majors in the workforce. The other half still ultimately focused on one or the other in graduate school or in their career [4].

For the majority of the Math double majors I interviewed, tuition prices were a large factor in their decision to double major. Many explained that with the rising cost of tuition (especially at private liberal arts colleges) it was just “economical” to major in two subject areas. According to Carl Moses, the provost at Susquehanna University, “students feel compelled to get as much out of the [college] experience as possible,” so they combat rising tuition costs by increasing their course load and number of majors [5]. But in fact, officials at many colleges and universities fear that students who choose this collegiate path will be very disappointed in the long-run. Indeed,

some career experts worry that students may discover that “multiple majors don’t necessarily improve employment prospects” [5]. Although a graduate with a double major appears to be more marketable, some employers could see them as someone who focused so much in only two disciplines that they “ignore[d] valuable skills and information taught outside of their majors” [5]. By narrowing down their college education to two or sometimes three disciplines, students “don’t have time to pick their heads up and see the world” [5]. Unfortunately, due to the lack of studies done on the effects of double majoring, it is difficult to say with any degree of certainty whether or not these fears and concerns are warranted. Perhaps if the recent trend in double majoring continues, more studies will be conducted and we will begin to have a better idea of its possible benefits and hindrances.

Although it is very difficult to determine whether or not Hood Math double majors experienced any of these drawbacks that have been a growing concern among experts, I believe that for the most part, these graduates have ultimately benefited from their choice to double major. From my interviews, I have concluded that most graduates feel secure career-wise in their Math major and they feel that they have benefited either financially (with an additional “hard” major) or creatively and intellectually (with an additional

“soft” major). I attribute this overall beneficial outcome to the fact that Hood is a private liberal arts college. The concern that double majors do not always get a wide scope of academia because of their narrow focus on only two disciplines does not really apply to students at Hood College. Students at Hood are going to receive a well-rounded education no matter what. Interdisciplinary overlap, or “cross-pollination” as Tepper and Pitt refer to it, is already built into Hood’s education system. A student’s choice to double major at Hood allows them an even more enriching education experience.

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