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Media Exposure on Student Work: Spotlight on Undergraduate Research

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Abstract

This paper describes efforts by the author to engage and motivate students in undergraduate research by giving them a large audience and engaging the media in disseminating their work. I provide an introduction to public relations from the point of view of a mathematics professor, and describe some lessons I've learned in my own attempts to engage newsprint, radio, and television sources in stories about undergraduate research in mathematics. After describing some partially successful early attempts, the paper discusses a recent event in which undergraduate research in mathematics became, briefly, a "hot news item" in Central Washington. The paper concludes with some thoughts about the benefits of this type of work to our students and our profession.

Introduction

I love mathematics. I also have a belief that I would guess is shared by most readers of this journal, that mathematics is far more interesting, exciting, and engaging than is usually believed by the general public. If I could have my way, I would want the entire world to know how much fun our field is. I know I am not alone in this desire.

I also love my students. Curious and motivated, I have experienced the joy that many research mentors feel when they see their students get really excited about their own mathematical discoveries, and I have been amazed at the quality of the work that they are sometimes capable of doing. I want the world to know about them, too. Again, I know I am not alone.

The paper contains the story of my attempts to stop simply wishing, and to tell the world (or at least a little corner of it) about my students and the mathematics they do.

Over the last few years, I've experimented with several methods of engaging the media to spread the word about the mathematics done by my students. In the process, I've learned several things not covered in my graduate education. I've learned that communicating with the general public through media professionals requires a different set of tools, skills, and even vocabulary than more traditional expository writing in mathematics. I have, through trial and error, picked up a few ideas about how to successfully interest media outlets in students' research work – this has led to stories in newspapers, radio interviews, three television interviews, and a variety of stories on the web. The primary goal of this paper is to share what I've learned, in hopes of making others' efforts at similar work more painless and more successful.

The media matters

Dealing with the media and with public relations professionals is not part of the standard training of many (any?) mathematicians. It can be difficult or frustrating in many ways, and it is worth performing a quick cost-benefit analysis before deciding to commit to such an endeavor. Does media attention bring enough benefits to make it worth the effort and hassle? I believe it does, for the reasons given below.

Professional benefit to faculty member and the department.

Media attention carries many benefits, some of which may not be apparent at first. Certainly it can be a boon to a faculty member's career to have a higher profile on campus. Positive media attention on the work done by our students also carries benefits to our home departments. It can be difficult to convince our administrators that the work done by mathematicians is important or valuable, and some mathematics departments complain that they are overlooked in favor of other disciplines which seem more relevant, important, or "sexy". A glowing story in a local newspaper can go a long way toward overcoming this discipline-based disadvantage.

Benefit to students

The largest benefit is surely the powerful effect that media attention has on our students. In my experience, students interpret positive attention on the web, in newspapers, or on television as a significant external validation of their work. When I listened to my students describe sending copies of newspapers home to their parents, or tell their friends that they had been on television (for doing math!), I heard a note of pride which was different than simply the pride of work well done. Instead, they believed even more deeply that they had mathematical talent, because strangers with no vested interest told them so. They believed that their work was important, because it merited several column inches of news type. The believed that they were part of something bigger than themselves – because they were.

Value to mathematics

It is worth noting that any positive media attention is also valuable to the field of mathematics itself. All mathematicians are aware of the common view held of their profession by the public, and of its usual portrayal by the media. Every news story which reports something unusual and exciting can only help our profession. Every television report which makes mathematics sound interesting is a good thing. We as a community have paid comparatively little attention to the public relations aspect of our work, and I believe we will see many benefits for mathematics if we put more of our attention in this direction.

Once we establish that publicity and media attention are useful, however, we are still left with a vexing question: how do we make it happen? In partial answer to this question, we turn next to a short introduction to the field of public relations.

A mathematician's introduction to public relations

I feel a bit sheepish writing this section. There are specialists in public relations. Our communications department offers a degree in the field, and my university employs people with a deep and nuanced understanding of the best way to communicate a message to almost any audience. I am not one of these people, and this article will not give you these skills – indeed, I do not possess them myself. Rather, in what follows I describe how a public relations office and media outlets appear to (at least)

one mathematician. I will describe resources likely available to you in your PR journey at the university, local, and national level.

The campus PR office

The best place to start your program of building public awareness of your students' work is your university's office of public relations. These departments have many names: "Public Relations", "Public Affairs", "The Communications Office", etc., but it's likely your school has one. A good first activity is to sit down and meet with someone in that office. This can be a slightly confusing meeting – communications professionals don't always speak the same language as mathematicians – but you can take solace in one crucial fact: you and they are on the same side. The primary role of people who work in these departments is to market and promote good things happening at your university. If we want to tell the world about our students' work, then we share their goal.

In my experience, public relations specialists expect that interactions with the math department will be unlikely to be even comprehensible, let alone fruitful. You can help the first meeting by bringing some ideas to the table. There's nothing wrong with being frank about your goals (you want the world to know about the great mathematics being done by students at your university). If you can suggest several things the students are doing that might be newsworthy, you should find the PR team happy to advise you on which they are most interested in, and what you can do.

Now that I have a relationship with my office (at my own Central Washington University, it is the office of "Public Affairs"), I regularly send them updates and ideas. Many of these, I should confess, fall to the wayside, and never see the light of day. This doesn't bother me – I see my role as keeping our office informed about the work my students are doing, and their role as deciding which of these are worth sharing with the wider world. If something looks interesting, I'll usually hear back quickly asking for more information, and we'll work together to craft a press release.

Press Releases

The primary device a university uses to communicate with the outside world is the *press release*. A press is a rather like a newspaper article, in that it gives basic information about a piece of news. Often, in fact, a press release is written just like a news article, and newspapers and websites will sometimes print these *verbatim* as stories. Somewhat more common, in my experience, is that the newspaper will minimally rewrite, borrowing liberally from the original release. In rare occasions, a reporter will read a press release and decide to write an original story. In these cases, the reporter may even call you for comments, or ask for suggestions of who else they could call for background.

If the best way to get your students' story out is to have your university issue a press release, how can you make this happen? This varies widely by school, but one technique I've used is to send a description of my students' work to the PR office as a press release draft, complete with a catchy beginning, a moderately-detailed middle section, and a short conclusion with a good take-away. This, in fact, gives us a chance to discuss the best ways to attract attention from media professionals.

What sells

It is perhaps unsurprising to learn that the things that interest media professionals are not identical to those that interest mathematicians. I have been told that if we want to interest people in our work, we should consider four things: *superlatives*, *fun adjectives*, *the surprise factor*, and *real-world applications*.

Superlatives are stories which include the word *most*, *best*, *first*, *longest*, etc. In my personal experience, while the media like such stories, administrators like them even more. Our presidents, provosts, and deans have an acute understanding of the fact that if they can say that their school is the <superlative> university in <anything at all, really>, then this is a fact they want to use often.

It's worth noting that, without violating accuracy, almost all research has superlatives. Almost by definition, new research is the *first* to discover something, to find a useful method with some application, or to establish a connection that hadn't been noted before. Given this, I've been surprised by how quickly adding a sentence like "these students are the first people ever to explore the question in the fourth dimension" changes the way the story is perceived and passed on.

Fun adjectives and *surprise* go together. Our PR offices want to put our schools in people's minds. The best stories are the kind that somebody will hear and then want to repeat. One of my favorite examples is one I heard recently from Michael Dorff at Brigham Young University. As an exercise in data analytics, a group of his research students scoured the internet using web scraping tools to determine the optimal pizza in Provo, Utah. Local television station Fox13 later reported that BYU students "used a mathematical formula to try and determine which pizza in Provo comes in at the perfect price". Math and pizza? It's the perfect story [8, 9].

The importance of *real-world applications* won't surprise anyone who has even tried to explain their mathematics research to somebody outside of the field. The importance of establishing some connection – however tenuous – with everyday experience is even more important when preparing a story for the media. When my students worked on the sum-of-divisors function from elementary number theory, our PR office asked whether our work had any applications to cryptography. I told them that probably it didn't, but that it was certainly possible, since questions about factorization and cryptography are often related. We settled on a compromise; the first press release reported that "a better understanding of weird numbers leads to a better understanding of factorization, which is the basis of all modern cryptography—the art of writing or solving codes." The statement may not mean much, but it wasn't false. Looking back, I find myself appreciative of their work – they really did want to make the public feel excited about mathematics. If a true but somewhat vacuous "hook" accomplishes this goal, I consider this a fair trade.

These lessons about sharing our mathematical stories may be best demonstrated by sharing a bit more of my own personal story. In the following, I include three vignettes. Each of these tells the story of one of my attempts to share mathematics with the public through the media, and some of the lessons I learned.

A personal journey

Vignette 1: Public Health and Statistics

During the summer of 2011, some faculty at my university won an NSF grant to work on a program improving students' critical thinking skills by engaging in Community-Based Inquiry (CBI). Being eager to participate, I talked with several people in our community and found a group, the Food Access Coalition,

who had a need for statistical help. They had conducted a survey of 800 residents of our county concerning food security. The person who had traditionally done data analysis for the county had moved to a new job, and the Coalition was eager to work with someone who could help them analyze and interpret the results of the survey. Joining Central Washington University's CBI grant, I built my next "Introduction to Statistics" class around the analysis of the data.

At the end of the term, my students submitted written reports and gave oral presentations to the board of the Food Access Coalition. Thinking that this was story in which they might be interested, I sent our Public Affairs office a note letting them know about the student presentations. The office was interested, and asked for more information. This seemed to be a problem at first. The PA office was interested in what, specifically, the students had found. My first response was that they had done a fairly complete summary of the data using description and elementary inferential statistics. This was useful, but hadn't led to anything particularly shocking. I mentioned, almost casually, that one student had found a significant association between whether a household owned a freezer and an index variable describing how difficult it was to find food.

This became the story. Later that week, the press release went out: *CWU students identify role of freezers in fighting hunger* [1]. The article, I was pleased to see, was great – it included an excellent summary of the students' work, and described in detail many of their findings. Based on what I heard over the next weeks and months, however, most readers took away only the title. It had been an educational introduction to the world of public relations.

Lesson learned: A story needs a bullet point to use as a quick take-home message. This will improve both the chances of the story's being picked up, and the chance that people will remember it.

Vignette 2: The Mathematics of Juggling

The next year, I published a paper (with Carsten Elsner and Erik Tou) in which my coauthors and I defined a zeta function on "juggling sequences" (a set of combinatorial objects based on ways to juggle, which had already been established in the literature), and studied several properties of this function [4]. I enjoyed working on the paper, though I should confess it was not of significant importance to our field. It struck me, however, that this may represent a perfect opportunity to put theoretical mathematics in the news – the word "juggling" is, to a non-mathematician, a surprising word to hear in the title of a paper in pure mathematics.

Our Public Affairs office did indeed like the story, and after they wrote the news release [2], I learned that there are many more options concerning where press releases can be submitted than I had previously guessed. Not only did they send the release to local television, newspaper, and radio outlets, but they also sent it to the International Juggler's Association! Here the prediction about the benefit of a "surprising" word held true: the story gained some traction. It appeared in a local newspaper, and a regional television station sent a reporter to interview me on campus.

Their outreach to the International Juggler's Association also led to some interesting opportunities. About a month later, a writer from the Association's newsletter contacted me for an interview, and asked me to submit an article explaining our work to their membership [3]. The original press push therefore led to an opportunity to write about mathematics for a popular audience – an area in which I have a lot of interest, but have not been certain how to enter.

There was, therefore, some career benefit to me that came out of the media attention. Nevertheless, I found some of the follow-up – notably the television interview – to feel stilted and artificial. The problem, I realized later, was that none of my students had been involved in the process. All the discussions of the mathematics that followed thus lacked the spark of energy and raw excitement that comes so naturally from working with students. I resolved that my next attempt for media attention on mathematics would again center on student work.

Lesson learned: Media attention is much less rewarding, and considerably less fun, without student involvement.

Vignette 3: Building on earlier lessons: Weird numbers

In Fall of 2013 I taught a lower-division "Math Honors Seminar". These one-credit seminars run each academic quarter in our department, and give faculty a chance to pursue exciting mathematics outside of the usual curriculum with our students, and to introduce students to skills not always taught in our standard classes. As part of that quarter, we worked on asking interesting mathematical questions.

Each student was assigned the task of finding an interesting number sequence on the Online Encyclopedia of Integer Sequences, and of bringing it to the class for "show and tell". This consisted of a short oral presentation describing the sequence, some of its mathematical properties, and posing a few open questions. One student, Luke Campbell, stumbled across *weird numbers*, and liked the name ("because I'm weird!", he explained).

A weird number is *abundant* – that is, it is larger than the sum of its proper factors, but not *pseudoperfect* – that is, it is not equal to the sum of any proper subset of its factors. The smallest weird number is 70: $70 < 1+ 2+ 5 + 7 +10 + 14 +35$, but 70 is not equal to the sum of any subset of these integers. Luke presented several properties known about weird numbers, and described the largest known weird number – a 53-digit integer discovered by Sidney Kravitz in 1976 [7].

His presentation also included some methods for finding large weird numbers – the process involves looking for large primes of a certain form – and it struck me that we could probably find a larger weird number than that of Kravitz. I further realized that if we succeeded, we would match all the criteria of a good story. We would have a superlative, a fun adjective, something a bit surprising, and a bullet-point take-away.

The students quickly got deeply engaged in our search, even offering to meet for extra sessions of our seminar before their other classes started, and we succeeded in finding several larger weird numbers, culminating in a 455-digit integer which we could show to be weird.

This did indeed turn out to be an ideal story that was easy to sell. Our PR office eagerly wrote it up, and the story appeared not only in the local paper, but on the front page of a regional daily [5]. Two radio stations called for interviews, and two television stations [6] came to campus to interview me and (crucially) some of the students! The headline "CWU students break world record: discover largest `weird' number" was just the thing to turn public attention toward mathematics.

My students, of course, were thrilled by the attention. Moreover, the media focus on mathematics accomplished everything I could have hoped for. Many people in Central Washington stopped and thought seriously about pure mathematics for a few minutes. I was asked about number theory at the

grocery store. One of my colleagues, a mathematician and a pilot, told me about a conversation he walked into at the local airport, in which a group of pilots were discussing the sum-of-divisors function, and were thinking about weird numbers. For a moment, people thought about mathematics not as something scary, but as something fun.

Lesson learned: When we combine elements of a good story with both students and mathematics, very exciting and positive things happen.

Student Response

I stated earlier that of the many positive benefits brought about by media attention on our students' work, the most significant is on the students themselves. One might reasonably ask, then, whether this experience had any impact on my students' mathematical careers. I cannot answer this definitively (I have a small sample size and no good comparison control group), but the anecdotal evidence seems promising. Of the five students in my "weird numbers" groups, none have since left the mathematical sciences. Three of them have taken on new research projects (two with other faculty members), three are attending or accepted into graduate school, and one is a practicing classroom teacher. I would be very interested in learning whether other mathematicians have had similar experiences with their students.

Conclusions

Understanding public relations and the media is still tricky – I still don't remotely feel that I have any real expertise in the area. The process of trying to figure it out as been really fun, however. Moreover, it's been tremendously rewarding. I have seen benefits to my own career, benefits for the perception of my department on our campus, and big benefits to boosting my students' attitude and confidence.

Our field rightly celebrates those who popularize mathematics; Steven Strogatz, Simon Singh, Ian Stewart, Keith Devlin, and many others have done a lot for our field. Thinking intentionally about engaging local media in the mathematical work of our students provides a way for a much larger group of mathematicians to do similar work on a smaller scale. An awareness and a celebration of student research in mathematics can and should be everywhere – I believe our field will be stronger when it is, and that everyone involved in undergraduate research can help to make this happen.

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