Problem-Based Career Exploration

Problem-Based Career Exploration

A Thesis Presented by
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Thesis Aims

General Aim

The general aim of this research is to establish a problem-based paradigm to organize professionals in oral health and beyond.

Specific Aims

Specific Aim 1a: To Re-Frame The Work Of Oral Health Professionals As A Problem They Address

Specific Aim 1b: To Use Keywords To Bring Context To Problem-Based Career Classifications And To Interlink Problems

Specific Aim 2: To Build A Problem-Based Career Network To Interlink Oral Health Professionals Across Disciplines, Fields, And Specialties Using A Two-Mode Graph

Specific Aim 3: To Categorize The Problems Oral Health Professionals Work To Address

Specific Aim 4: To Publish Problem-Based Digital Stories That Highlight The Problems Oral Health Professionals Work To Address

Innovation

Problem-based career exploration allows people to frame their interests and exploration around a problem they would like to address instead of focusing on a specific job which may or may not exist as the employment landscape changes in the United States and globally.

Gone are the days when a job signifies a long-term relationship between a company and an individual. In 2016, the median employee tenure for 25 to 34 year-olds in the United States was 2.6 years (1). The uncertainty of what job to pursue is a challenge for those finishing high school and college; many of the jobs that people have today did not exist twenty years ago. Likewise, jobs that will emerge twenty years from now, may not be able to be predicted. Through problem-based career exploration, a learner is charged to 'create value' around a defined problem or challenge. They are challenged to understand that many disciplines, professions, and jobs have utility in solving their problem/challenge of concern; there will always be opportunity to solve those problems, even if the jobs landscape changes. Cars made obsolete the horse carriage industry. Digital cameras thinned the film industry. Digital trading turned stock brokering upside down. Digital advertising crippled the newspaper advertising industry. According to Rick DeLong, "*Everything that can be digitized is being digitized. Anything that can be automated will be automated"(2)*. Dentistry is not immune. It is only a matter of time before machines, technology, algorithms and improved oral health challenge the jobs done by individuals in the field. These shifts however, will not eliminate the wide scope of existing and emerging problems we will face in the field as they relate to access, prevention, development, and beyond. Oral health extends beyond clinical general dentistry, and showcasing our work according to the problems and challenges we work to address is an innovative approach to helping learners understand how to

develop a personal kit of skills and expertise that have application and create value for the employment and entrepreneurship landscape of tomorrow.

The second innovation of this project is that it offers a way to conceptualize the way students explore careers, and a way for advising systems in colleges and universities to harness student's intrinsic motivators. Furthermore, this helps to reinvigorate the spirit of exploration, entrepreneurship and innovation into a generation that is risk averse. Schools can frame their curricula, not only as a set of courses, but as a way to understand a problem of concern from a variety of disciplinary perspectives so that they may be a part of the solution upon graduation, and as they inherit society. A final innovation of this project comes from its emphasis on networks. Because networks represent an important social resource, it is important to recognize that access to networks is stratified on education and race. People who have had access to higher education have larger networks, and their networks have more range and tend to introduce new information and perspective to such individuals. It has been found that having people who have many "weak ties" have at their disposal social capital that creates opportunities for social mobility (3). Non-whites in the U.S. have smaller networks than whites (4). This is an important consideration because the U.S. demographics are in flux. It is projected to become a majority-minority nation for the first time in 2043 (5). Problem-Based Career Exploration attempts to recapitulate and democratize hidden professional career networks, and to de-silo the thinking of explorers to create a more integrated, collaborative paradigm for exploring careers. Hopefully this new paradigm can assist us in equitably distributing information and career possibilities to all corners of our society.

Background – Reimagining How We Think About Dental Careers

Problems in Oral Health

Dental caries is the most common infection of childhood, and oral disease is the most common of all chronic diseases (6). The consequences of oral disease are substantial. In industrialized countries, 60–90% of school-aged children and the vast majority of adults experience dental decay (7). In the U.S., adults annually miss 2,442,000 days of work due to acute dental conditions (8) and children annually miss 52,000,000 hours of school (9). In the Bulletin of the World Health Organization (WHO), they cite that dental caries, periodontal disease, tooth loss, oral mucosal lesions and oropharyngeal cancers, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS)-related oral disease, and orodental trauma are public health problems worldwide, with the greatest burden of oral diseases experienced by disadvantaged and poor populations (7). To achieve major improvements in oral health we must look across professional, disciplinary, and national boundaries. According to Oral Health in America: A Report of the Surgeon General, "too little time is devoted to oral health and disease topics in the education of non-dental health professionals" (10). This could be restated that the principle problems in oral health are unknown to non-dental professionals.

Academic Dentistry: a set of disciplines or a set of problems?

Today's students seem to be narrowly focused on a private practice clinical career; only 2% of graduating seniors are considering a career in academic dentistry (11). A great deal of innovations come out of basic and clinical research that address the needs of the public's oral and systemic health (12). According to Dr. Bertalomi, Dean of the NYU Dental School, when students are challenged to consider academic life, it is asking them to dispense with their settled career

aspirations (13). Rupp et. al. found that 91% of all responding schools had formal or information initiatives to prepare, recruit, and retain faculty, but concluded that the students they surveyed lacked the knowledge and information necessary to make informed decisions regarding the pursuit of a career in academic dentistry (14). In their discussion they stated

"while the dental profession as a whole has done a superb job of selling the benefits of a private practice career, the same message regarding an academic career often goes unvoiced and therefore unheard by dental students, except for varied and anecdotal observations of faculty life, which students may encounter from individual instructors as they progress through dental school" (8). While we have worked hard to acquaint the people with dental products and services, we have not presented people with the problems we need their help solving. We have not framed academic dentistry, or tributaries of our field according to the problems the field of oral health works to address.

Encouraging Early Career Exploration

Schneider found that "efforts to encourage career interests in an occupational field should begin early in the educational process and become more formalized in high school" (15). Data on graduating dental students mirror this. When asked when they made the decision to pursue dentistry as a career, 52 percent of pre-dental students said they decided in college, and 33 percent made the decision in high school (16). For many students who pursue dentistry, this early exposure comes from observing family members, relatives, and friends who work in the dental field. In fact, the biggest factor influencing students to choose dentistry as a career is having a family member or friend who is a dentist; this is true for 31% of dental students (11). If a person lacks a family member in the field, or if they do not receive early exposure to careers in oral health

as potential pathways, people may not include oral health, academic dentistry, and clinical dentistry as career possibilities.

The Need To Expand the Dental Pipeline

Groups underrepresented in dentistry often lack familial and social network connections, which are the primary channels through which knowledge of careers in dentistry are disseminated. Furthermore, groups and individuals may have had poor or limited experiences with the dental profession. African-Americans comprise just 2.2 percent of active dentists versus 12 percent of the population, Hispanics comprise 2.8 percent of active dentists versus 10.7 percent of the population, and Native Americans comprise 0.2 percent of active dentists versus 0.7 percent of the population (17). Ethnic and racial diversity in academic dentistry researchers and educators is bleak. Of the full-time dental faculty members, 0.3 percent reported being American Indian/Alaskan Native, 9.6 percent Asian, 4.5 percent Black or African American, 8 percent Hispanic or Latino, and 0.2 percent Native Hawaiian or Pacific Islander (18). The Robert Wood Johnson Foundation's Dental Pipeline Program, in collaboration with The California Endowment and the W.K. Kellogg Foundation is an example of a well-funded on-going program that attempts to recruit and matriculate underrepresented minority students into dental school (19). Unfortunately, these programs do not reach everybody. New strategies are necessary for expanding the dental pipeline to ensure that the future oral health workforce represents the increasing multi-cultural landscape of the American public. Dr. Francis S. Collins, director of the National Institutes of Health (NIH) stated that, "lack of diversity jeopardizes our ability to carry out the NIH mission because innovation and problem solving require diverse perspectives" (20). The National Institute for Dental and Craniofacial Research incorporated these imperatives into their strategic plan (21).

Silos and the Disciplinary Divide

Over the past decades, we have witnessed an unprecedented growth in data, information, and knowledge. To organize this information, we have created highly specialized journals, research institutes, professions, and disciplines. While this intense specialization serves the institutions and organizations that maintain them, these silos are becoming increasingly irrelevant to students who are non-experts. As this unprecedented knowledge growth splinters higher education into narrow disciplines and areas of specialization, colleges and universities have the opportunity to become integrated, interdisciplinary learning communities that focus on societal issues (22). This opportunity exists not only in universities but also in research. According to the National Institute of Health Roadmap, "the scale and complexity of today's biomedical research problems increasingly demand that scientists move beyond the confines of their own discipline" (23). There are multiple approaches to break down silos. Multidisciplinary research "draws from different disciplines but stays within their boundaries," interdisciplinary research "analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole, while transdisciplinary research "integrates the natural social and health sciences in a humanities context and transcends their traditional boundaries" (24).

Problems Obey Neither Disciplinary Nor Professional Boundaries

While the need for interdisciplinary, interprofessional, and cross-sector collaboration is now widely understood we must first develop a new way to frame our research, our work, and our careers – not in their boundaries or silos but at their intersections. In describing the keys to his success, Nobel Laureate Dr. Sydney Brenner explained that "the thing is to have no discipline at all…biology got its main success by the importation of physicists that came into the field" (25). Computer scientist, Dr. Daniels Lemire, stated that "it is by trying to solve important problems

that significant science comes about" (26). Thus, crossing disciplines is not just a catch phrase, but is necessary for the advancement of and innovation in science. Recently, the NIH Fogarty International Center released its strategic goal priorities which include the promotion of research networks, and the stimulation of linkages among disciplines to address complex global health problems (27). Transdisciplinary fields like urban planning and global health allow us to be thoughtful about the way in which the field is defined. In fact, according to Dr. Paul Farmer – a leader in healthcare delivery –"global health is not a discipline or field but rather a collection of problems" (28).

A Problem-Based Paradigm Aligns with the Mindset of the Millennial Generation

The literature suggests that the millennial generation engages with information in a completely new way compared to previous generations. Digital Natives are no longer mere readers, listeners, or passive viewers but are active participants in public conversations using the internet and other technologies (29). Not only are millennials comfortable with technology, they orient their work according to an inner imperative. Today's 18- to 29-year-olds are devoted to addressing global problems (30). In fact, 86 percent agreed with the statement *'it is important to me to have a career that does some good in the world*' (31). Academic advisers have a unique opportunity to help students think about the ways in which they would like to improve the world; this might be framed as a problem of interest to the student. In a study of what makes successful students, researchers found that "at key points in their college years, an academic advisor asked questions, or posed a challenge, that forced them to think about the relationship of their academic work to their personal lives" (32). One successful student in this study stated that their adviser "kept pushing me to relate my coursework to my own interests." Organizing work according the problem people solve in their role, allows students to gauge whether that problem piques their curiosity and their

interests. Next, it gives the student the potential to explore and comprehend how many disciplines, professions, and fields contribute to addressing that specific problem. Perhaps, if students are asked to define a problem they would like to address in the world, it helps them to actively foster an inner imperative, and to use their education to understand and solve those problems.

According to the Merriam-Webster Dictionary, a problem is simply defined as, "a question raised for inquiry, consideration, or solution" *(33).* This definition is flexible enough to define most types of work. A problem-based career taxonomy also leaves space for students and professionals to examine the ways that different disciplines and professions intersect to solve societal problems. In fact, Choi emphasizes how working across disciplines reconnects the disconnected units of knowledge to the whole and helps to achieve new insight for complex problems (34). The field of oral health is inundated with problems in need of inquiry, consideration, and solutions. Orienting students across the learner spectrum to such problems and showcasing how we collaborate to address these important issues will bring them from the shadows into the light.

Telling 'The Story Behind The Resume' Humanizes Career Exploration

It is often difficult to share our passion for discovery with all students (35) considering face-to-face interactions play such an important role. There is, however, an opportunity to leverage technology to reach these individuals. According to the Digital Youth Project, to stay relevant in the 21st century, educational institutions need to keep pace with the rapid changes introduced by digital media (36). Dr. Kumar, Dean of Digital Learning at MIT and Dr. Iiyoshi, Director of the Center for the Promotion of Excellence in Higher Education at Kyoto University explained that, "we need to think about how technology, content, and knowledge about learning and teaching

can be creatively combined to enhance education and ignite students' passions, imaginations, and desires to participate in constant learning about (and sense making of) the world around us" (37).

The use of video technology is an often-used approach for career information dissemination. One of the first examples of this was in 1994 where student-made videotapes of culturally specific role models were created to promote health careers among Native American Youth in Wisconsin. An increase in students' knowledge was achieved, based on the results of pre-test and post-test questionnaires (17). A similar study was performed with medical students in 2008; it was found that a promotional DVD was useful in increasing awareness of psychiatry as a career path (38). While effective in a circumscribed population, these two examples reflect a limited approach to information dissemination because they are centralized, closed, and only a select few can participate.

It is important to understand that mere dissemination of information will no longer suffice. In the book, Story Factor, Simmons asserts that: "

> *"…People don't want more information. They are up to their eyeballs in information. They want faith- faith in you, your goals, your success, in the story you tell. It is faith that moves mountains, not facts. Facts do not give birth to faith. Faith needs a story to sustain it – a meaningful story that inspires belief in you and renews hope that your ideas indeed offer what you promise" (39).*

That is, the magic of influence is less dependent upon content and more dependent upon how it is delivered. "Telling a good story is like giving a mini-documentary of what you have seen so others can see it too" (39). According to Dr. Ellen Brinkley, a Professor of English at Western Michigan University, a finished digital story looks something like a short autobiographical, documentary film." She recommends that storytellers:

> *"record a personal narrative voice over, and to use software to layer their voiceovers with any images that help tell the story including still photos, video clips, text animation, soundtrack, other effects to create a highly personal and densely packed exploration of a topic through story"* (40).

The impact of digital stories can be amplified using the power of the Internet. According to Tapscott, peer collaboration introduces scalability and a wide reach when accomplished because it harnesses human skill, ingenuity, and intelligence more efficiently and effectively than anything we have witnessed previously. It allows us to amass collective knowledge distributed in networks and allows us to mobilize people more efficiently than a series of individuals acting in isolation (41). Digital stories focused on the problems that oral health professionals are working to solve will give students an opportunity to learn about the inner imperatives of these professionals, and to gain such exposure needing nothing more than an internet connection.

Technology Offers An Unprecedented Opportunity to Engage Today's Learners

The U.S. government recognized the importance of leveraging technology to engage learners in new ways. With respect to learning, the U.S. Department of Education's National Education Technology Plan (NETP): Learning Powered by Technology plan mentions that:

> *"The model of 21st century learning described in this plan calls for engaging and empowering learning experiences for all learners. The model asks that we focus what and how we teach to match what people need to know, how they learn, where and when they will learn, and who needs to learn. It brings state-of-the art technology into learning to enable, motivate, and inspire all students, regardless of background, languages, or disabilities, to achieve. It leverages the power of technology to provide personalized learning instead of a one-size-fits-all curriculum"* (42).

The NETP Plan also discussed the infrastructure needed or learning in the 21st century:

> *"Over the past 40 years, we have seen unprecedented advances in computing and communications that have led to powerful technology resources and tools for learning. Today, low-cost Internet access devices, easy-to-use digital authoring tools, and the web facilitate access to information and multimedia learning content, communication, and collaboration. They provide the ability to participate in online learning communities that cross disciplines, organizations, international boundaries, and cultures"* (42).

To remain silent in the digital realm is to effectively remain absent in the minds of students who might strive for careers in academics, research, teaching, and in solving the pressing problems we face in oral health. This limits the ability of stakeholders to expand and diversify the pipeline that will develop the future oral health workforce.

Preliminary Work

Designing Digital Stories for Career Exploration

The purpose of this first preliminary project was to determine how to shape digital stories for career guidance leading to the creation of a new paradigm for career exploration.

Methods

This project was launched in the Educational Software Design course (T-522) in the Technology, Innovation and Education Program at the Harvard Graduate School of Education. Session 1: the class of graduate students in the course convened to decide the types of stories that should be told by professionals in their video clips. A video interface was created that profiled three individuals with those stories (see Appendix A for The Realm of Possibility Pilot Interface). During a second session, students in the course viewed the video clips, and responded to an online survey which asked: 1) how can we improve this concept, 2) what background information should be included on each person, 3) how long should the videos be, 4) what other content should be included in the profiles, and 5) other recommendations and suggestions. Google Sites was used to create the video interface. Twenty-one graduate students were asked to view the profiles for the pilot and to respond to the survey.

Results

Of the 21 participants, 17 completed the survey during the first session. The group concluded that each profile would feature 4 stories that highlight the person's career, their non-work passions, a challenge they overcame, and their source of inspiration. The second session elicited their suggestions to improve the system including: 1) showing the content creators in action, 2) understanding how they overcame failure, 3) presenting a typical day in their life, 4) helping

students network and connect to resources, 5) collecting keywords to enable search, 6) making the length of the videos less than two minutes, 7) adding demographic data and user-specific meta-data, 8) discussing work-life balance and other influences on career decisions, and 9) adding the person's personal strategies for success. Multiple respondents mentioned that the profiles must be creatively organized to help end-users to find relevant resources.

Conclusion

The use of digital stories is a plausible way to allow students to explore previously unimagined career possibilities. The graduate students' evaluations of the piloted profiles suggested the importance of enhancing the interface, and to showcase profile frameworks that more deeply portray the individuals featured.

Developing Digital Stories for Career Exploration: Global Health - A Proof of Concept

The emerging field of global health (including oral health) captures the interest of an increasing number of high school, college, and graduate students. Because global health crosses many disciplines, professions, and fields, students find it hard to understand the pathways they might take to launch a career in this field. Global health is expansive and lends itself well for the piloting of a new channel through which students can explore unimagined careers within the field.

Since global health is a transdisciplinary field that draws talent and expertise from an array of disciplines and professions this work was conducted with the Harvard Global Health Institute (HGHI). According to Dr. Paul Farmer, "Global health is not a discipline or field but rather a collection of problems" (28). Based upon the first preliminary study (Designing Digital Stories for Career Exploration), a framework for creating digital stories and a website to distribute these stories were developed to help students to identify role models, mentors, and career trajectories focused on the specific problems students are passionate about solving in global health. The site was named The Realm of Possibility and the internet domain http://therealmofpossibility.org was purchased.

The purpose of this pilot was to create a resource that encourages students to explore the Unknown Unknowns and to translate them into Known Knowns through deliberate exploration; I call it Problem-Based Career Exploration.

Organizing such a resource requires a new paradigm. As the working world and the academic world hyper specialize, the common thread linking people from different domains are the problems that they solve. We took the opportunity to implement the paradigm of Problem-Based Career Exploration for the transdisciplinary field of global health.

Methods

This proof of concept is based upon work for the lessons from the previous pilot (Designing Digital Stories for Career Exploration). A meeting was held with Sue Goldie, Faculty Director of HGHI. The Institute staff collaborated to launch a pilot to organize their global health faculty according to the Problem-Based Career Exploration Paradigm. Fifteen profiles were planned for development, as well as a simple web interface to host the profiles.

To capture the digital stories of the HGHI faculty, an interview guide was developed to standardize the interview. Salary, credentials, and earning potential were not included in the topics discussed. The PPI was comprised of two parts: (1) the audio story where the interviewee introduces her/himself, the problem s/he works to address, and tells a brief personal story that humanizes her/his work, and (2) the Extended Profile (EP) survey, ten separate interview questions. The EP was devised to allow end-users to learn more deeply about the path of the contributor.

Based upon the lessons from the insight gained from the preliminary study, Designing Digital Stories for Career Exploration, participants were asked to answer the following questions for the audio story portion:

1. "What problem are you currently working to solve?"
2. "Please tell us a personal story that gives students a glimpse into the importance of this problem, why you care about it?"

For the EP survey participants were asked the following questions:

1. "What problem are you currently working to solve?"
2. Describe who you are, where you're from and your current role / job / profession / area

of study.

3. Can you describe the path that led you to where you are now (major, internships, jobs), and how your path changed over time?

4. Who or what inspired you to take the path you took?

5. What are some of the enjoyable parts of what you do? What are some of the downsides of what you do?

6. What is an obstacle that you had to overcome in your career? How did you overcome it?

7. What is your vision for working on the problem that you are invested in solving? How do you propose we get there?

8. What types of interests and activities do you maintain outside of your work?

9. Can you recommend three articles or books that positively impacted you that students might benefit from reading?

10. What piece of advice do you have for students who are in the process of discovering their passion?

HGHI hired an intern to conduct the interviews of global health professionals. Each interviewee was contacted via e-mail to setup the interview. Each interview was recorded using a digital recorder and a microphone, and was saved as an MP3 file. Each participant signed a copyright transfer form.

The audio was transcribed to text and edited to create an audio story approximately two minutes in length. Headshots and action pictures of the interviewees were collected. The tool to collect categorization and demographic data was named the Interconnections Survey which was was sent to the participants after the interview (see Appendix B for the Interconnections Survey).

The audio files, headshots, and profile details were uploaded to a website created for the distribution of the stories. The site, named http://therealmofpossibility.org, was the distribution framework for the problem-based career exploration paradigm.

Results

A total of 15 professionals were interviewed across the field of global health. After soliciting interview requests, it was decided to switch to audio profiles instead of video profiles to increase the number of participants (many were reluctant to consent to video interviews, and were more likely to agree to an audio interview). The interviews were transcribed and added to The Realm of Possibility website and were named Professional Pathways Profiles (see Appendix C). The interview guide evolved into the Professional Pathways Interview Guide over the course of the pilot including more nuanced questions, prompts to increase face validity, and questions to more thoroughly tell the digital story of the interviewee.

Conclusion & Future Directions

This work provided rich lessons that facilitated the development of a working model for The Realm of Possibility, an interprofessional problem-based career exploration website. This proof of concept showed that problem-based career profiles are a viable way for an organization to showcase careers in their field using digital stories. This system has the potential to showcase work the public is not generally exposed to and it creates a channel through which we can foster ongoing dialogues between students and practitioners across disciplines and professions.

Assessing Students' Ability to Frame Their Interests as a Problem

Harvard Students for Global Health, a university-wide student group, got IRB approval to survey students across the university to understand the ways in which students experience interdisciplinary collaboration in their programs. A secondary goal of the study was to understand if students can frame their interests as a problem by sampling students from across disciplines, schools and professions.

Methods

In 2013, graduate and undergraduate students across Harvard University were surveyed through a Social Inequalities Survey. The survey was designed to investigate: 1. Students' interests and academic experiences as they pertain to social inequality in all its forms, 2. The role of different disciplines in addressing social inequalities and, 3. Opportunities for multidisciplinary partnerships towards addressing social inequalities. Demographic data was collected including the student's school and degree program, and the professions they are interested in pursuing have pursued in the past. IRB approval was achieved. Each participant was required to answer the question, "What problem in the world would you most like to help solve?" They were also asked, "What potential for PARTNERSHIP do you see between YOUR AREA OF STUDY and the FOLLOWING DISCIPLINES towards addressing social inequalities?" A list of 50 areas of study were provided.[1] Participants were also asked, "Choose one of the disciplines you selected above that is outside your own area

[1] List of areas of study: Earth sciences, Physics, Chemistry, Biology, Neuropsychology, Biomedicine & pharmacology, Clinical medicine & dentistry, Public health & epidemiology, Environmental studies & ecology, Agriculture & livestock, Anthropology, Sociology, Religious studies & theology, Gender & sexuality studies, Area & cultural studies, Geography, Education studies, Development studies, International relations, Military sciences, Public policy & administration, Political science, Law, Commerce & international trade, Economics, Finance & accounting, Marketing, Business administration, Entrepreneurship, Mathematics & statistics, Computer & information science, Electrical engineering, Mechanical & materials engineering, Civil engineering, Biomedical engineering, Systems engineering, Urban planning, Architecture, Design, History, Philosophy, Literature, Languages, Linguistics, Journalism & communication studies, Creative writing, Music, Theatre & dance, Visual arts & film, Recreation, sports, and leisure studies.

of focus. How could you partner with this discipline to address social inequalities? What would such a partnership look like? What barriers do you see to this partnership and how would you overcome them?" The survey was sent to student e-mail lists across the 12 schools of Harvard University.

Results

177 students participated in the survey. 100% of the respondents were able to describe their professional interests in terms of a problem they would like to address. Of the 177 responses, five originated from dental students, three of which are listed below.

Example Responses: Problems that Dental Students Would Like to Solve

Student 1 Problem: "Disparities in access to healthcare (specifically, access to dental care but access to healthcare in general as well)"

Student 1 Collaborative Solution: "Finance & accounting/computer science & dentistry/clinical medicine - A major reason for poor access to oral healthcare is because Medicaid reimbursements are so low, and the majority of dentists work in a private practice setting and have to deal with very high overhead costs. Obtaining Medicaid reimbursements is a labyrinthine process, and help from those with accounting/programming experience may be able to design programs to help dentists deal with the red tape of Medicaid billing. This in turn might mean that dentists could accept more Medicaid patients."

Student 2 Problem: "I would most like to help solve social inequalities towards the LGBTQ community within the field of medicine. There is a stigma that still exists against openly gay doctors that needs to be addressed and I think that it is important to raise awareness to current

medical professionals as well as to younger generations. Closeted youth should not feel as if they have to choose between being gay or entering into a competitive profession, such as medicine, if that is where their true passions lie."

Student 2 Collaborative Solution: "Visual arts & film: visual arts can be a powerful venue to exhibit an idea in a meaningful way. I am currently working on a project using photography to capture images of out LGBT Harvard doctors and medical students, both in a professional setting and a personal one, to express the idea the one does not have to choose between their profession and sexuality."

Student 3 Problem: "Professionally, the gross inequity in oral health between disenfranchised people and those with access to more resources in this country, and the inequity in oral health between those in developing countries and developed countries. I would like to better integrate dentistry in the medical system so it is seen as a right rather than a privilege."

Student 3 Collaborative Solution: "Dental educators rarely get a professional education in teaching and teaching studies, and I think this would increase the effectiveness of dental educators and their ability to passionately recruit students to address social inequalities in their careers and make them more aware of the existence of social inequalities within dentistry."

Conclusion

Students across the disciplinary spectrum including dental students can frame their interests as a problem they would like to address and potential collaborative solutions. There is merit in framing work in a problem-based manner.

Specific Aim 1a: Re-Frame The Work Of Oral Health Professionals As A Problem They Address

Background

Oral health encompasses much more than cleaning, drilling, filling, and straightening teeth. Students, however, are not always exposed to the range of career possibilities that exist in our field. Allied professionals like 'technologists,' 'researchers,' 'psychologists,' 'public health advocates,' and beyond, are indispensable in improving the public's oral health, but their role is often invisible. Professional silos do not make intuitive, the ways in which people collaborate and leverage their skills to make an impact. To assist students, the public, and people in our own field in exploring unimagined careers, we created Problem-Based Career Exploration. While this problem-based approach has potential application to any profession or discipline, this study examines whether oral health professionals can frame their work as a problem.

In the preliminary study, Assessing Students' Ability to Frame Their Interests As A Problem, we found that 100% of students were able to do so. The purpose of this study was to determine if oral health professionals could frame their work as a problem. With this understanding, a robust resource can be built to showcase these professionals using digital stories to highlight the ways in which their work leads to improved oral health. This will allow us to expose students and the public to the problems that need their creativity, energy and insight.

Methods

This study used in-depth one-to-one interviews. The Longwood Medical Area IRB approved the study as exempt (IRB14-3889-1). To identify and recruit participants into the study, we used a snowball sampling approach (43) to identify three to four individuals from each of the following six career (work) categories including research/teaching, public-health/policy, government/public

service, business/entrepreneurship, grassroots-work/ advocacy, and clinical. Each participant was sent a recruitment e-mail which described the purpose of the study. Potential participants were also sent an example profile and the Professional Pathways Interview Guide (see Appendix C for the complete Interview Guide). Both traditional and non-traditional work activities under the umbrella of oral health were solicited. An attempt was made to recruit an equal number of women and men. The sampling was geographically limited to the Greater Boston Metropolitan Statistical Area which is defined by the U.S. Office of Management and Budget and the U.S. Census, and includes the eastern third of Massachusetts, and the area south of Manchester NH, north of Providence RI, and east of Worcester, MA. The sampling techniques attempted to include participants from diverse racial backgrounds including Black/African-American, White, Hispanic/Latino, Native American, Asian groups and others.

A semi-structured survey instrument, called The Professional Pathways Interview Guide, was used to conduct the individual interviews. Each participant responded to twenty-one questions about their work, including defining their work as a problem. The Professional Pathways Interview Guide (developed during the Global Health: A Proof of Concept Pilot) was created to capture the digital stories of working professionals across disciplines and professions. Possibility Profiles elicit 12 dimensions of a person's life including: (1) the problem they work to address, (2) skills, (3) advice on exploration, (4) their unique path, (5) their inspiration, (6) their job, (7) how they create value, (8) collaboration, (9) their vision for the future, (10) their principles and values, (11) the impact of their education, (12) and their approach to happiness. A total of 21 questions elicit this information and the full list of questions can be found in Appendix C.

Content validity was achieved with the help of an intern who restated the questions in her own words to ensure that the questions were being interpreted as intended. The Professional Pathways Interview Guide was pilot tested for face and content validity. Discrepancies between her understanding of the questions and the intentions of the questions were used to enhance the interview questions. Face validity was achieved during the collection of interviews for the Realm of Possibility pilot (see the Preliminary Study: Global Health A Proof of Concept). Participants in the pilot were asked to point out any questions that were problematic, were asked to suggest new questions and critiqued the question order. This occurred during the interviews of 15 professionals both inside and outside of the field of global health, from a range of professional and disciplinary backgrounds. Clarifying descriptions were written to further explain the interview questions. As the interviews for this specific aim were completed, the order of the questions were changed to complete a story-telling arc with the most personal questions reserved for the end of the interview.

The interviews were planned around the participant's schedule, and the interviewer traveled to their location. The interviews were approximately one hour and 15 minutes in length. Prior to the interview, informed consent was obtained from the participants. Each interview was recorded using a digital recorder and a microphone, and was saved as an MP3 file.

Each participant was asked: "What problem are you currently working to address?" They were then asked, "to reduce the description of the problem you work to address down to 12 words or less." Post-interview, each person was asked to "list as many keywords as possible that are associated with the problem you work to address."

Referrals for the snowball sample were solicited at the end of each interview. The Interconnections Survey collects the participant's demographic and categorization data, so that they were properly categorized in their profile, and in search queries (see Chapter 5 for the content of the Interconnections Survey.) The Interconnections survey was administered electronically after the administration of the Professional Pathways Interview. Participants were given the option to complete the Interconnections Survey at a later time if they had time constraints. The MP3 audio files were cut into tracks, transcribed, and checked for accuracy.

Results

A racially diverse group of 23 oral health professionals participated (14 women, 9 men including Asians, Blacks, Latinos, and Whites). The snowball sample included oral health professionals from a wide range of fields and disciplines including: dental insurance, dentist, oral physician, family physician, assistant professor, oral surgeon, dean, physician, health services researcher, dentistry, pediatric dentistry, health care consultant, clinical psychology, public health dental hygienist, educator, epidemiology, dental oncologist, dental officer in the U.S. Army National Guard, dental hygienist, registered dietitian, nutritionist, clinical psychiatry, dental education, entrepreneur, orthodontist. 100% of the participants were able to define their work as a problem they work to address, based upon their responses. See Figure 1 for the full list of problems they address, their areas of study, their response to the prompt asking them to define their work as a problem, and the keywords they listed.

Figure 1: Participants' Professions, Areas of Study and the Problems They Work to Address

N	Self-Defined Profession	Areas of Study (including undergraduate and graduate school)	Career Framed As A Problem They Work To Address
1	Profession Clinical Psychiatry, Educator	Areas of Study Medical Science, Psychology, Medicine, Health Communication, Health Policy & Management	Problem Working To Advance Health Professions Education To Foster Patient-Centered Collaborative Practice
	Keywords: interprofessional, interprofessional education, I.P.E., dental education, medical education, collaborative care, health professions training, communication skills training, patient centered care, teamwork, team communication, healthcare collaboration, healthcare planning, healthcare		
2	Profession Dental Hygiene, Nutrition	Areas of Study Nutrition Science & Policy, Educational Leadership in Postsecondary Education	Problem Advancing The Profession Of Dental Hygiene
	Keywords: dental hygiene, workforce issues, associates dental hygiene, masters in dental hygiene, advancing dental hygiene education		
3	Profession Family Physician	Areas of Study Government, Medicine	Problem Integrating Oral Health Into General Health
	Keywords: H.I.V., diabetes, pregnancy, mouth health, wellness		
4	Profession (not provided)	Areas of Study (not provided)	Problem Increase The Number Of Mass Health Members Who See The Dentist
	Keywords: inform, education, access to care, overall health		
5	Profession Dental Insurance	Areas of Study Political Science, Business Administration	Problem To Improve The Oral Health Of All

	Keywords: dental, mouth, mission, insurance benefits		
6	Profession Dentist	Areas of Study Hispanic American Literature, Dentistry	Problem To Help Students To Stay Focused, To Stay In School And To Get An Education Or Career In Dentistry
	Keywords: quality care, affordable care, Hispanic community, mentorship, nutrition, clinical care, smoking, outreach, hypertension, early intervention, pre-dental students, health center		
7	Profession Post-doctoral dental residency education, Clinical pediatric dentistry, Health care consultancy	Areas of Study Biology, Dentistry, Pediatric Dentistry, Business Administration, Health Care Management	Problem Increasing Access To Oral Health Through A Distributed Model Of Dental Education
	Keywords: global, pediatrics, health, poverty, clinical outcomes, cost of care, disease, health systems, healthcare delivery, patient satisfaction, research, evidence-based, healthcare disparities, disenfranchisement, dental specialty education, diverse, multicultural, innovative, enabling, medicine		
8	Profession Clinician, Educator, Researcher	Areas of Study Zoology, Dentistry, Oral Biology, Periodontology	Problem The Integration Of The Sciences And Also Getting Students To Treat Their Patients In A Comprehensive Care Model
	Keywords: educator, researcher, clinician, motivator, basic science / clinical science integration, comprehensive care, patient-centered care, integration		
9	Profession Physician, Health Services Researcher	Areas of Study Medicine, Public Health, Epidemiology	Problem Finding Holistic Ways Of Better Integrating Oral Health Into Delivery Of Pediatric Primary Care Services
	Keywords: obesity, holistic, parents, perspectives, early childhood, primary care		
10	Profession Dental Assisting	Areas of Study Elementary Education, Psychology, Educational Administration	Problem Improving Oral Health In Developing Countries

	Keywords: access, global oral healthcare, dental externships, sustainable programs, sustainability		
11	Profession Dentist, Professor, Entrepreneur	Areas of Study Computer Science, Math, Biology, Dental Medicine	Problem Increase Access To Oral Heath Care By Leveraging TeleHealth Technologies
	Keywords: triple aim, population health, dental medicine, dentists, social entrepreneurship, public policy, alternative care delivery models, disruptive innovation, healthcare innovation, telehealth, telemedicine, teledentistry, better health outcomes, dental caries, harvard, university of Pennsylvania, wofford, tufts school of dental medicine, harvard business school, harvard innovation lab, pay-it forward, startup, hygienists, preventative healthcare, social impact, entrepreneurship, doing good while doing well, C.N.S. triple aim, preventative healthcare models, innovation, public health		
12	Profession Oral and Maxillofacial Surgeon, Dean	Areas of Study Chemistry, History, Medicine, Dental Medicine	Problem To Promote The Integration Of Dental And Medical Education So That There's An Impact On The Health Care Delivery System
	Keywords: integration of oral health and primary care, catalytic mechanisms, medical-dental integration		
13	Profession Dentistry, Oral Physician, Public Health	Areas of Study Pre-Med, Psychology	Problem Improving Health In Resource Poor Settings On The Local And Global Levels
	Keywords: capacity, cross-training, treatment, group appointments		
14	Profession Clinical Psychology	Areas of Study Psychology and Narrative, Spanish, Clinical Psychology, with a specialization in Health Psychology Public Health with a Specialization in Health Policy, Management, and Leadership	Problem Behavioral and Public Health Approaches to Improving Rural Oral Health

	Keywords: Psychology, health psychology, behavioral dentistry, social justice, health inequity, Appalachia, rural health, oral health inequity, women's oral health, oral health disparities		
15	Profession Epidemiology, Research Professor	Areas of Study Health Sciences, Public Health, International Health, Epidemiology	Problem Evaluate and Eliminate Dental Disparities
	Keywords: disparities, epidemiology, periodontal disease, racial/ethnic minorities, disadvantaged populations, early childhood caries		
16	Profession Primary Care Pediatrician	Areas of Study Medicine, Public health	Problem Health Communication and Oral Health
	Keywords: health literacy, culture, culturally appropriate services, linguistically appropriate services, health beliefs, health behavior, dentistry, communication		
17	Profession Dentist	Areas of Study Business, Public health, Oncology	Problem Discrepancy Between Medical and Dental Coverage for Patients with Cancer Experience in the field known as Dental Oncology
	Keywords: health disparities, dental oncology, cancer, implants, reconstruction, rehabilitation, oncology, radiation, chemotherapy, surgery, stem-cell transplants, bone marrow transplants, underinsurance, lack of insurance, health inequities		
18	Profession Dentistry, Geriatrics	Areas of Study Biology, Dentistry, Geriatrics	Problem Changing the Way Dental Care is Delivered for Older Adults
	Keywords: interdisciplinary, team based care, public health dental hygienist, portable dentistry, primary care dentistry, older adults, access to dental care, social determinants of health, geriatrics		
19	Profession Coordinator	Areas of Study American Government Law & Policy	Problem Organizing Pro-Fluoridation Activity in Massachusetts
	Keywords: oral healthcare, fluoridation, childhood tooth decay, tooth decay, elder tooth decay, organization, stakeholders in oral health in Massachusetts, chronic disease, water fluoridation, oral health, prevention, teeth		

20	Profession Public Health Dental Hygienist, Educator	Areas of Study Dental Hygiene, Communication Disorders, Education	Problem We Are Working To Address The Access To Oral Health Care For Children In Massachusetts
	Keywords: community, dental social worker, children, special needs, collaborative practice, children with special healthcare needs, collaboration		
21	Profession Dentist, Orthodontist	Areas of Study Dentistry	Problem Oral Health Disparities of the Asian-American Population
	Keywords: none provided		
22	Profession Clinical Psychologist	Areas of Study Biology, Psychology, Chemistry	Problem Dental Pain Sensitivity and Fear of the Dentist
	Keywords: dental care, behavioral genetics, fear, anxiety, pain, dental fear, dental pain, pain perception, behavioral sciences, training		
23	Profession Surgeon, Educator	Areas of Study Physiology, Anatomy, Dentistry	Problem Minimally invasive oral and maxillofacial surgery as an educator and caring surgeon
	Keywords: maximally invasive, minimally invasive, translational science, education, trainees, teacher, mentor, mentee, doctor, surgeon, person		

Discussion

While a person's profession, discipline, field, sector, or specialty can be described in one or a few words, a problem-based description of someone's work often requires a lengthy description which can encompass dozens to hundreds of words. This was evidenced in the interview. This is an advantage as it provides nuance for someone who might never have contemplated someone's work in this way. To condense these expansive problem-based descriptions of the participants' work, we asked each person to succinctly describe their work. We asked them to "reduce the

description of the problem you work to address down to 12 words or less." These descriptions then became the title of the person's profile.

Problem statements require context. If someone is reading a succinct problem statement, we want them to understand the domain of the person's work without having to read an entire paragraph, thus we asked each person to provide an exhaustive list of keywords 'associated with the problem they work to address. This is important because people in the same profession or discipline can work on different problems. Similarly, people working on similar problems leverage different professional and disciplinary contexts to their work. For example, "Access to Oral Health…" was part of three participants' problem statements, however each one is achieving it through different professional pathways: one through education, one through pediatrics, and one through technology. Contextualizing the problem-statement with the keywords grounds the person's work in that individual's unique context and adds complexity and nuance to an otherwise simple way of categorizing people and their work.

One issue that comes up using a problem-based system for categorization is the reality that many people can frame their work in terms of multiple problems. We address this in the question stem by directing the participant to, "choose one, and keep that one in mind as you proceed through the interview." This ensures that they are more apt to focus on a singular problem arc in the interview.

While we successfully reduced a person's career down to a succinct problem statement, and added context using keywords, the interview and profile of each participant contains a wide array of questions to deepen the non-expert's understanding of the problem the participant works to address. These specific questions come from the PPIG (Appendix C) and include:

1. **Why is this problem important?** This question acknowledges that the audience may not have been exposed to this problem before. It creates a sense of urgency, highlights purpose driven-work, and to bring the specific problem you address into perspective for non-experts.

2. **How do you address this problem?** This question highlights how the specific individual approaches this problem in a specific way, which will vary across disciplines, professions, and fields.

3. **What skills help you to successfully address this problem?** Having the person describe the skills that are valuable in addressing this problem helps people to reflect upon building skill sets – many of which may be soft-skills that aren't specifically taught in the classroom.

4. **Please suggest books, articles or other resources that will help people explore this problem**. This question helps people to become self-starters and to acquaint themselves with the fundamental literature, media, and information about the problem so they can take their learning into their own hands.

5. **With whom do you collaborate to address the problem you work on?** Collaboration is the cornerstone of problem solving, and this question helps people to understand how different individuals, groups, and institutions work collaboratively to solve problems.

6. **What is your vision for the problem you are working to address? How do we get there?** This question casts perspective toward the future and invokes the human ability of vision. Vision helps people to frame solutions to the problems, and creates a bridge between our current reality and our possibility in the future. This is the prerequisite for problem solving and is the foundation for innovation.

Conclusion

Oral health professionals can frame their work as a problem they work to address. This approach adds granularity, depth, and context to the work of oral health professionals across disciplines and professions. This paradigm could aid students in imagining a wider range of pathways through which to leverage their skills, knowledge, and training to improve oral health. This paradigm can be applied to fields beyond oral health to help the next generation to understand the problems that need their creativity, insight, and energy.

Specific Aim 1b: Use Keywords To Bring Context To Problem-Based Career Classifications And To Interlink Problems

Background

Because Problem-Based Career Exploration is a novel approach to categorizing and organizing careers, novel ways of navigating this paradigm are necessary. Keywords are widely used in academic journals to aid researchers and investigators in locating relevant content and literature. To our knowledge, keywords have not been used to provide context for a problem-based paradigm for career categorization. The aim of this project is to investigate if professionals can offer keywords related to the problem they work to address.

Methods

The same participants and general methodology were used as described in Specific Aim 1a. After each Professional Pathways Interview, each participant was sent a link inviting them to participate in the Interconnections Survey, which collects meta-data on the participant, their career, and captures the ways in which they categorize their work and their demographics. Question 28 asked, "Please list as many keywords as possible that are associated with the problem you work to address."

Results

Of the twenty-three participants in the study, twenty-one (91%) completed the Interconnections Survey. Only the participants who completed the survey were included in the keyword analysis. The total number of keywords mentioned by the participants was 285; the mean was 13.4 keywords and the mode was 11. The most frequently listed keywords were: (17) oral health, (8) education, (8) dentistry, (6) access to care, (4) overall health, (4) prevention, (3) dental care, (3)

health disparities, (3) healthcare, (3) primary care, (3) health, (3) integration, (3) pediatrics, (3) public health, (2) access, (2) behavioral dentistry, (2) collaboration, (2) communication, (2) community, (2) dental hygiene, (2) diabetes, (2) disparities, (2) early childhood caries, (2) geriatrics, (2) global, (2) H.I.V., (2) health inequities, (2) health psychology, (2) interprofessional, (2) medicine, (2) population health, (2) pregnancy, (2) psychology, (2) social justice, (2) teeth, (2) training, (2) triple aim, (2) and wellness.

The remaining keywords (162) were mentioned a single time (although some keywords were variations on one another:

> Access to dental care, advancing dental hygiene education, affordable care, alternative care delivery models, anxiety, Appalachia, associates dental hygiene, basic science / clinical science integration, behavioral genetics, behavioral sciences, better health outcomes, bone marrow transplants, C.N.S. triple aim, cancer, capacity, catalytic mechanisms, chemotherapy, childhood tooth decay, children, children with special healthcare needs, chronic disease, clinical care, clinical outcomes, clinician, collaborative care, collaborative practice, communication, communication, communication skills training, comprehensive care, cost of care, cross-training, culturally appropriate services, culture, dental, dental caries, dental education, dental externships, dental fear, dental medicine, dental oncology, dental pain, dental social worker, dental specialty education, dentists, disadvantaged populations, disease, disenfranchisement, disruptive innovation, diverse, doing good while doing well, early childhood, early intervention, educator, elder tooth decay, enabling, entrepreneurship, epidemiology, evidence-based , fear, fluoridation, global oral healthcare, group appointments, Harvard, Harvard business school, Harvard innovation lab, health behavior, health beliefs, health center, health inequity, health literacy, health professions training, health systems, healthcare collaboration, healthcare delivery, healthcare disparities, healthcare innovation, healthcare planning, Hispanic community, holistic, hygienists, hypertension, I.P.E., implants, inform, innovation, innovative, insurance benefits, integration of oral health and primary care, interdisciplinary, interprofessional education, lack of insurance, linguistically appropriate services, masters in dental hygiene, medical education, medical-dental integration, mentorship, mission, motivator, mouth, mouth health, multicultural, nutrition, obesity, older adults, oncology, oral health inequity, oral healthcare, oral healthcare, organization, outreach, pain, pain perception, parents, patient centered care, patient satisfaction, patient-centered care, pay-it-forward, periodontal disease, perspectives, portable dentistry, poverty, pre-dental students, preventative healthcare, preventative healthcare models, primary care dentistry, public health dental hygienist, public policy, quality care, racial/ethnic minorities, radiation, reconstruction, rehabilitation, research, researcher, rural health, smoking, social determinants of health, social entrepreneurship, social impact, special needs, stakeholders in oral health in Massachusetts, startup, stem-cell transplants, surgery, sustainability, sustainable programs, team based care, team communication, teamwork, teledentistry, telehealth, telemedicine, tooth decay, treatment, tufts school of dental medicine, underinsurance, University of Pennsylvania, water fluoridation, Wofford, women's oral health, workforce issues.

Discussion

Each keyword represents an entry point into the exploration of the field of oral health. While the keywords apply to our specific sample, the data will become more expansive, more relevant, and more robust as more individuals are included. During the analysis, it became apparent how issues of oral health can be linked to other fields through keywords. It will be important to determine a way to ensure that the keywords are directly relevant to the problem people are working to address; this could be achieved by asking people to rank the keywords as being strongly or weakly related to the problem for example.

Disciplines, professions, sectors, and specialties operate at the boundaries of groups of people and attempt to separate people into mutually exclusive units. Many categorizations are arbitrary and often are dictated by politics, vary across institutions, and change over time. For example, millions of dollars per year are spent to establish, negotiate, and challenge the boundaries between hygienists, dentists, oral physicians, dental therapists, and sub-specialists in the field. While these definitions potentially benefit professionals who define themselves by these labels, they are authoritatively imposed, and do not always describe the nuance of the work the person is doing. A problem-based approach allows individuals to self-define their work that builds into the description and introduction to the imperative behind the work. Keywords represent an opportunity for nuance behind that problem to be quickly communicated to a non-expert.

Below we can see how this nuance enhances the scope of someone's work, and brings context to his or her work. Respectively, these keywords were provided by a periodontist, a general dentist, and an administrator of 3rd party payer. While they work in very different corners of the field, each one named "Access To Oral Health" when asked to describe the problem they work to

address in 12-words or less. Taking a quick glance at their keywords bring context and nuance to the work they are doing, and are defined completely by the individual.

Increasing **Access To Oral Health** Through A Distributed Model Of Dental Education (periodontist)
Keywords: global, pediatrics, health, poverty, clinical outcomes, cost of care, disease, health systems, healthcare delivery, patient satisfaction, research, evidence-based, healthcare disparities, disenfranchisement, dental specialty education, diverse, multicultural, innovative, enabling, medicine.

Increase **Access To Oral Health** Care By Leveraging TeleHealth Technologies (general dentist)
Keywords: triple aim, population health, dental medicine, dentists, social entrepreneurship, public policy, alternative care delivery models, disruptive innovation, healthcare innovation, telehealth, telemedicine, teledentistry, better health outcomes, dental caries, harvard, university of Pennsylvania, wofford, tufts school of dental medicine, harvard business school, harvard innovation lab, pay-it forward, startup, hygienists, preventative healthcare, social impact, entrepreneurship, doing good while doing well, C.N.S. triple aim, preventative healthcare models, innovation, public health.

Access To Oral Health Care For Children In Massachusetts (3rd party payor)
Keywords: community, dental social worker, children, special needs, collaborative practice, children with special healthcare needs, collaboration.

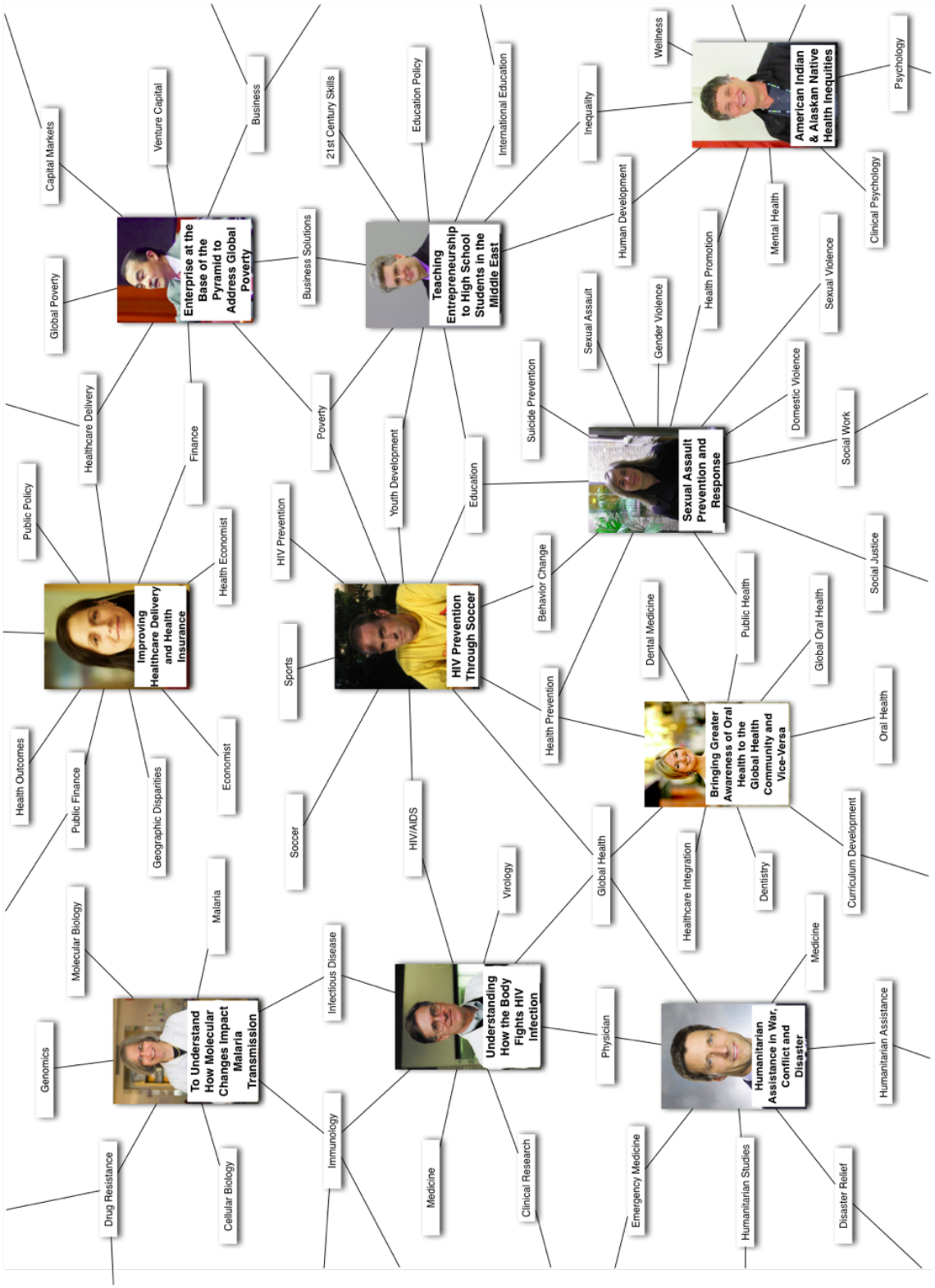
These keywords can be used as starting points for individuals exploring careers. By interlinking the keywords and the problems people are working to address, we create a nexus between people who are working on different problems, but from different disciplinary and professional perspectives. To apply the network framework to our data, we created a visualization of Problem Networks, by creating a graph (network) linking the problems people address during our Global

Health Proof of Concept Pilot and the keywords they associated with the work they do. The assembled network allows easy traversing from one field to another, facilitating serendipitous discovery of people and the problems and they address. These visualizations intuit the interdisciplinary and inteprofessional nature of work around well-defined problems in oral health, and in any field, see Figure 2 for the Example Problem Network Visualization (built using a subset of the data from the Global Health Proof of Concept Preliminary Study).

Assembling a Problem Network

To apply the network framework, the title of the problem each interviewee is working to address was associated with a thumbnail profile photo, creating the primary nodes in the network. The keywords collected from the Interconnections Survey became secondary nodes. The profession, discipline, and specialty of the individual collected from the Interconnections Survey also served as secondary nodes. When interviewees had coincident secondary nodes, the interviewees were connected via that common node, leading to the construction of a network; for example, if two interviewees were both epidemiologists, they would both be connected to that secondary node.

Figure 2: Example Problem Network Visualization



Conclusion

Associating problem-based descriptions of an individual's work with an exhaustive set of self-defined keywords adds context and nuance to work descriptions of oral health professionals. Problem Networks represent a novel way of creating a 2-mode network (see specific aim 2 for more background behind 2-mode networks) that grounds problem-based work into descriptive keywords which can be used to create a robust network that simply yet powerfully abstracts the interconnections between the work done by people across professions, disciplines, institutions, specialties, traversing socially constructed silos, geo-political and geographic borders to aid career explorers in the discovery of possibilities they may never have imagined.

Specific Aim 2: Build A Problem-Based Career Network To Interlink Oral Health Professionals Across Disciplines, Fields, And Specialties Using A Two-Mode Graph

Background

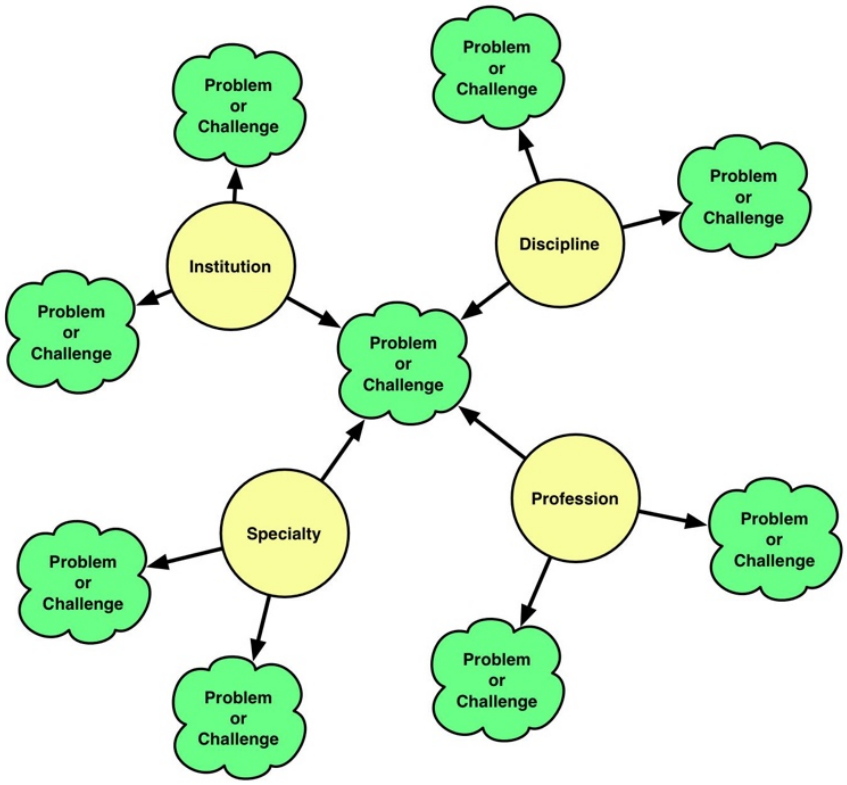
Problem-Based Career Networks are an innovation created from this research by applying the fundamentals of network theory to our concept of Problem-Based Career Exploration. This paradigm allows non-experts to appreciate, visualize, and traverse the non-obvious networks that link oral health professionals, and professionals across professions, disciplines, and sectors of the economy. The purpose of this aim is to build an oral health problem-based career network that can be studied mathematically, and that can serve as a resource to digitally map the oral health landscape.

Highly diverse network ties help develop more complete, creative, and unbiased views of issues (45) and oral health could benefit from being more enmeshed more generally in health. A great deal of studies have been done to understand social and biological networks and the structure properties of networks (46). Networks have an application to health such as to understand and influence the spread of sexually transmitted diseases (47), the spread of obesity (48) biomedical research collaboration (49, 50) and to understand co-authorship networks (51). Network science is now being recognized as a tool to understand disease, norms, and the dissemination of information in the field of oral health (52). Specifically network science has been used to understand how networks can be used to understand the spread of misinformation about oral health on social networking websites (53). The Lancet Commission recommended "that to promote interprofessional and transprofessional education, we must break down professional silos while enhancing collaborative and non-hierarchical relationships in effective teams" (54).

Social network analysis has been criticized for being simply descriptive in nature but there is a great deal of information contained in the structure and ties of social networks (55). In fact, the types of ties that are analyzed include: 1) Similarities such as location, group membership, and attributes, 2) Social Relations such as kinship (friend of / mentor of), roles, affective relationships (like/dislikes), and cognitive relationships (knows, doesn't know), 3) Interactions (sexual / advising), and 4) Flows (information / advice) (55).

Networks have two fundamental elements: the node, and the edge (line). An edge is simply a connector between two or more nodes. Nodes can represent anything from people to organizations, and beyond. Affiliation networks, also known as two-mode networks contain two separate types of nodes (44), see Figure 3 for an example 2-mode network.

Figure 3: Cartoon of a 2-Mode Network



Problem Networks were created to move away from a silo approach to organizing professions and disciplines (membership). Problem Networks are two-mode networks and the first-mode-nodes represent people (including metadata that describes the problem they work to address). The second-mode-node represents affiliation data including the individual's profession, specialty, discipline, or keywords they associate with the problem they work to address. Effectively, this transforms the silos into connectors.

Methods

The same cohort of participants interviewed in Specific Aim 1 was included in this Specific aim. The participants' profession, discipline, specialty, and keywords associated with the problem they work to address were sourced from the Interconnections Survey. The structure of our 2-mode Problem-Based Career Network Graph designates the problem the individual is working to address as the primary nodes, and the secondary nodes as the exhaustive list of keywords they cited as being associated with the problem they work to address. We used Gephi version 0.9.1, an open-source software package for the visualization and analysis of network data. We created two separate CSV tables in Microsoft Excel, 1) a table listing the problem each participant works to address, and 2) a table containing the list of keywords the person associates with the problem they work to address. We decided to use keywords as our secondary nodes because each keyword is mutually exclusive. The data on specialties, professions, and disciplines were not mutually exclusive categories rendering them impossible to analyze in Gephi. Furthermore, the purpose of this study was to move beyond professions, disciplines and specialties to describe people's work.

Once the problem node and the keyword node tables were created, each node was given a unique ID. An edge list was created (edges connect nodes). When participants have coincident secondary

nodes (keywords), they are linked with an edge (line) via that common secondary node, leading to the construction of a network; for example, if two participants listed epidemiology, they would both be connected to the 'epidemiology' secondary node. The software assembled the network using the data in the table.

Analysis

Networks can be analyzed to glean information about the structure of the network as well as the nature of the interconnections. We analyzed the degree, centrality, and closeness of the nodes in the network. Degree is represented mathematically by:

$$C_D(n_i) = \sum_j x_{ji}$$

This equation means the degree (of a specific node) is equal to the sum of the nodes it is connected to (55).

Centrality helps identify the most important actors in a social network, and closeness centrality is a specific type of centrality. It is an index is useful in identifying prominent actors who are extensively involved in collaborations with other actors. More specifically, it represents that sum of the lengths of the shortest paths between the node in question and all other nodes in the network, and is represented by the following equation (55):

$$C_A = \frac{\sum_{i=1}^{g} [C_A(n^*) - C_A(n_i)]}{\max \sum_{i=1}^{g} [C_A(n^*) - C_A(n_i)]}$$

Betweenness centrality is a measure that tells us the degree to which a node lies on the vertex that lies between paths between nodes. The equation for betweenness centrality is (55):

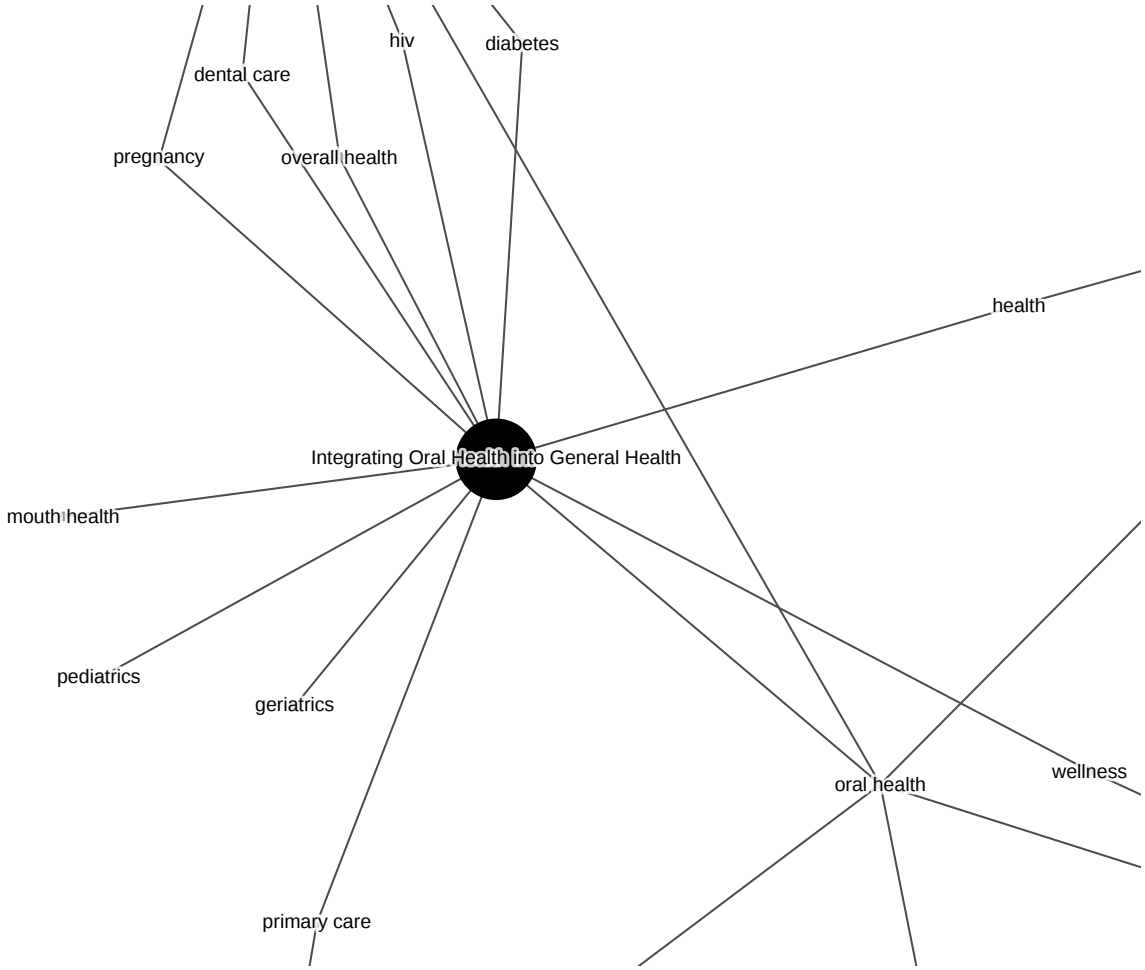
$$C_C(n_i) = \left[\sum_{j=1}^{g} d(n_i, n_j) \right]^{-1}$$

This is a measure of influence. More influential nodes are part of more vertices, and if they are removed, the network will be more highly disrupted/disconnected than if a node with lower betweenness centrality is removed. In other words, high betweenness tells us who holds the network together (55).

Results

Twenty-one of the 23 interviewees (91%) submitted responses to the Interconnections Survey, thus the data tables and the 2-mode Problem-Based Career Network were built using their responses. The data set (the same data set as previous mentioned) contained a total of 21 problems, and 285 keywords. When the keywords mentioned by multiple people were consolidated into single secondary nodes, the graph contained 198 secondary nodes (the keywords) along with the 21 primary nodes (the problems). A total of 281 edges linked these primary and secondary nodes. Figure 4 is an example of a primary node and its linked keywords.

Figure 4: Zoom into a Primary Node and its Secondary Linked Nodes



See Appendix D for the complete 2-mode network for the Oral Health Problem Network.

Degree: Because our network was a 2-mode network, containing two types of nodes, we analyzed them separately. Running this equation, we calculated that our primary nodes (which represented the problems our participants work to address) had the following degree values:

Figure 5: Primary Nodes Arranged By Descending Degree

Primary Nodes (Problem Statement)	**Degree**
Increase Access to Oral Heath Care by Leveraging Telehealth Technologies	33

Increasing Access to Oral Health Through a Distributed Model of Dental Education	27
To Help Students to Stay Focused, to Stay in School and to Get an Education or Career in Dentistry	20
Discrepancy Between Medical and Dental Coverage for Patients with Cancer Experience	18
Working to Advance Health Professions Education to Foster Patient-Centered Collaborative Practice	16
Dental Pain Sensitivity and Fear of the Dentist	16
Access to Oral Healthcare for Children in Massachusetts	14
Changing the Way Dental Care is Delivered for Older Adults	14
Behavioral and Public Health Approaches to Improving Rural Oral Health	12
Integrating Oral Health into General Health	12
Organizing Pro-fluoridation Activity in Massachusetts	12
To Improve Health in Resource Poor Settings on the Local and Global Levels	11
To Improve the Oral Health Of All	11
Finding Holistic Ways of Better Integrating Oral Health into Delivery of Pediatric Primary Care Services	10
Improving Oral Health in Developing Countries	10
Helping Dental Students to Treat Their Patients Using a Patient-Centered Comprehensive Care Model	9
Evaluate and Eliminate Dental Disparities	9
Health Communication and Oral Health	9
Advancing the Profession of Dental Hygiene	7
Increase the Number of MassHealth Members Who See the Dentist	6
To promote the integration of dental and medical education so that thereï¿½s an impact on the health care delivery system	5

In other words, the degree of the primary nodes represented the number of keywords listed by the participant. The degree of our secondary nodes represented the number of problems associated with a specific keyword.

Figure 6: Secondary Nodes Arranged By Descending Degree

Secondary Nodes	**Degree**
oral health	17
education	8
dentistry	8
access to care	6

overall health	4
prevention	4
integration	3
pediatrics	3
primary care	3
health disparities	3
public health	3
health	3
dental care	3
healthcare	3

The above secondary nodes had the highest degree, and were thus connected to the largest numbers of problems people were working to address. If a student using our network to explore careers was interested in 'access to care' we could offer them profiles on 6 people who are working on a specific problem space relating to access to care.

Closeness: In our graph the closeness centrality ranged from 2.22 to 4.89. This means that the shortest path from the oral health node (our secondary node / keyword) with the highest degree, every node in the network is an average of 2.22 nodes away. A student who traverses our network and follows a random edge (link) from this node will have the highest chance of coming across the full range of primary nodes (problems) enmeshed in the network (55).

Figure 7: Closeness of Most Central Secondary Nodes

Secondary Nodes	**Degree**	**Closeness Centrality (lowest)**
oral health	17	2.2247
dentistry	8	2.9495
access to care	6	3.0412
education	8	3.1238
public health	3	3.3440
healthcare	3	3.4266
triple aim	2	3.4449
health	3	3.4816
pediatrics	3	3.4908

dental care	3	3.5183
overall health	4	3.5275
global	2	3.5825

It is important to point out that while degree plays a large part in calculating closeness in our network, it is the structure of the edges (links) that organize the paths between nodes. Below, we can see that the patient-centered care and comprehensive care nodes have the highest closeness meaning that they the path from this node to all other nodes in the network are about 4.89 nodes away on average.

Figure 8: Closeness of Least Central Secondary Nodes

Secondary Nodes	**Degree**	**Closeness Centrality (highest)**
healthcare planning	1	4.6376
educator	1	4.8944
researcher	1	4.8944
clinician	1	4.8944
motivator	1	4.8944
basic science / clinical science integration	1	4.8944
comprehensive care	1	4.8944
patient-centered care	1	4.8944

A more powerful glimpse of the power of interconnections is demonstrated when we look at the closeness of the primary nodes (problems). As seen below, degree plays less of a role in centrality; for the primary nodes that represent the problems people address, in fact, is the connectivity of the secondary nodes that dictate the closeness of the primary nodes, not just the sheer number of connections. For example, a primary node will be 'closer' to other nodes in the network if it has a high degree secondary node (keyword) like 'oral health' or 'access to care' connected to it.

Figure 9: Closeness of Primary Nodes

Primary Nodes	Degree	Closeness Centrality
To Help Students to Stay Focused, to Stay in School and to Get an Education or Career in Dentistry	20	2.72
Increasing Access to Oral Health Through a Distributed Model of Dental Education	27	2.73
Access to Oral Healthcare for Children in Massachusetts	14	2.77
Increase Access to Oral Heath Care by Leveraging Telehealth Technologies	33	2.79
Improving Oral Health in Developing Countries	10	2.81
Increase the Number of MassHealth Members Who See the Dentist	6	2.85
To Improve the Oral Health Of All	11	2.92
Discrepancy Between Medical and Dental Coverage for Patients with Cancer Experience	18	2.93
Health Communication and Oral Health	9	2.94
To Improve Health in Resource Poor Settings on the Local and Global Levels	11	2.97
Dental Pain Sensitivity and Fear of the Dentist	16	2.99
Changing the Way Dental Care is Delivered for Older Adults	14	3.01
Behavioral and Public Health Approaches to Improving Rural Oral Health	12	3.03
Integrating Oral Health into General Health	12	3.03
Finding Holistic Ways of Better Integrating Oral Health into Delivery of Pediatric Primary Care Services	10	3.06
Organizing Pro-fluoridation Activity in Massachusetts	12	3.11
Evaluate and Eliminate Dental Disparities	9	3.14
To promote the integration of dental and medical education so that there's an impact on the health care delivery system	5	3.18
Advancing the Profession of Dental Hygiene	7	3.43
Working to Advance Health Professions Education to Foster Patient-Centered Collaborative Practice	16	3.64
Helping Dental Students to Treat Their Patients Using a Patient-Centered Comprehensive Care Model	9	3.89

Betweenness Centrality: In our graph, the highest betweenness centrality is related to the number of keywords the individual provided, especially if those keywords were cited by other individuals

in the study. This connects their primary node to other secondary nodes and thus have more influence in the network.

Figure 10: Betweenness of Primary Nodes

Primary Nodes	Betweenness Centrality
Increase Access to Oral Heath Care by Leveraging Telehealth Technologies	5967.7
Increasing Access to Oral Health Through a Distributed Model of Dental Education	4512.8
To Help Students to Stay Focused, to Stay in School and to Get an Education or Career in Dentistry	3291.7
Discrepancy Between Medical and Dental Coverage for Patients with Cancer Experience	3003.8
Working to Advance Health Professions Education to Foster Patient-Centered Collaborative Practice	2665.3
Dental Pain Sensitivity and Fear of the Dentist	2427.0
Access to Oral Healthcare for Children in Massachusetts	2401.1
Changing the Way Dental Care is Delivered for Older Adults	2114.4
Organizing Pro-fluoridation Activity in Massachusetts	1884.6
Behavioral and Public Health Approaches to Improving Rural Oral Health	1612.7
Health Communication and Oral Health	1570.8
Helping Dental Students to Treat Their Patients Using a Patient-Centered Comprehensive Care Model	1551.8
Improving Oral Health in Developing Countries	1493.1
To Improve Health in Resource Poor Settings on the Local and Global Levels	1479.5
To Improve the Oral Health Of All	1479.4
Finding Holistic Ways of Better Integrating Oral Health into Delivery of Pediatric Primary Care Services	1459.6
Evaluate and Eliminate Dental Disparities	1154.6
Integrating Oral Health into General Health	1007.6
Advancing the Profession of Dental Hygiene	997.0
Increase the Number of MassHealth Members Who See the Dentist	737.4
To promote the integration of dental and medical education so that there's an impact on the health care delivery system	694.0

The most influential primary node is, Increasing Access to Oral Health Care By Leveraging Telehealth Technology.

Discussion

To build a more connected network, it is important to increase the interconnections between nodes. This was achieved by increasing the number of primary nodes (the number of participants describing the work that they were working to address. This was also increased by encouraging people to exhaustively list keywords by give them time to think of, report, and add revise the keywords that are associated with the problem they work to address. This will increase the degree of the primary nodes, and will help the keywords to lead explorers to problems that have a similar keyword, but linked to problems that are similar by approached by people from different disciplines and professions.

Conclusion

Problem Network Visualizations intuit the interdisciplinary and interprofessional nature of work around well-defined problems in oral health, and in any field. The problem network has the opportunity to help people to visualize the less-than-obvious interconnections between the people who address similar problems from different disciplinary and professional fields. The collaboration data came from their response to a question in the Interconnections Survey that asked them to name the constituencies with whom they collaborate to address the problem they work on. This system can be digitized and an interactive visualization can be created to help learners explore this network, the problems that people work to address, and they can use keywords as an entry point for discovering career possibilities and digital stories of people they would not otherwise be exposed to.

Specific Aim 3: Categorizing The Problems Oral Health Professionals Work To Address

Background

Advances in medical research have greatly decreased morbidity and mortality in the United States (56). This advancement has been paired with increased specialization, new disciplines and sub-disciplines, and an array of new professions and para-professions. Similarly, clinicians and researchers are now working on increasingly narrow domains of health. While this makes most sense for the professionals, it separates the human health into disconnected territories.

In the 2003, the National Institutes of Health released the National Institute of Health (NIH) Roadmap, where they discussed the need to employ research teams in future biomedical research. They explained that "the scale and complexity of today's biomedical research problems increasingly demand that scientists move beyond the confines of their own discipline" (23).

According to Choi (2006) multidisciplinary research "draws from different disciplines but stays within their boundaries", interdisciplinary research "analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole, while transdisciplinary research, "integrates the natural social and health sciences in a humanities context and transcends their traditional boundaries" (24). Working across disciplines not only reconnects the disconnected units of knowledge to the whole, it also helps to achieve new insight for complex problems, particularly when the combined disciplines are disparate (34).

Disciplinary Lines

To create innovative ways to think about crossing disciplinary boundaries, we must first establish a framework to understand disciplines. While each institution may have its own way of organizing

the sciences (some have interdisciplinary department structures, some have a rigid disciplinary-based systems), Turnbull created a hierarchy of disciplines in natural sciences as follows:

> Natural sciences: physics, chemistry, genetics, biology, anatomy, geography, and astronomy (57).

Choi added the following hierarchies to include all disciplines:

> Health Sciences: pharmacology, biochemistry, physiology, pathology, epidemiology, clinical medicine, palliative medicine
>
> Social Sciences: clinical psychology, psychology, sociology, economics, political sciences, international studies, theology
>
> Engineering Sciences: mathematics, electrical engineering, computer engineering, mechanical engineering, civil engineering, urban planning, space engineering
>
> Management: accounting, finance, marketing, human resource management, business administration, commerce, international management
>
> Humanities: history, languages, music, visual arts, theater, communication, philosophy (34).

This division of the knowledge universe is a useful framework for classifying the approaches that scientists take in their work, and is useful in placing them into discrete categories that lend themselves to analysis.

Innovation

To harness a problem-based paradigm for organizing careers, it is important to create a systematic and rigorous system for categorizing our data. The goal of this system was to transcend disciplinary and professional definitions of careers, while developing a simple, intuitive, meaningful system to help people navigate the career landscape. Furthermore, our problem-based career system is built upon the nodes of a network that grows and changes over time, so

our system must be able to adapt to a dynamic graph in the context of increased complexity and size over time. In the literature, there currently is no standardized way of categorizing problems, nor is there a problem-based categorization system so the Outlaw Problem-Based Index, was created.

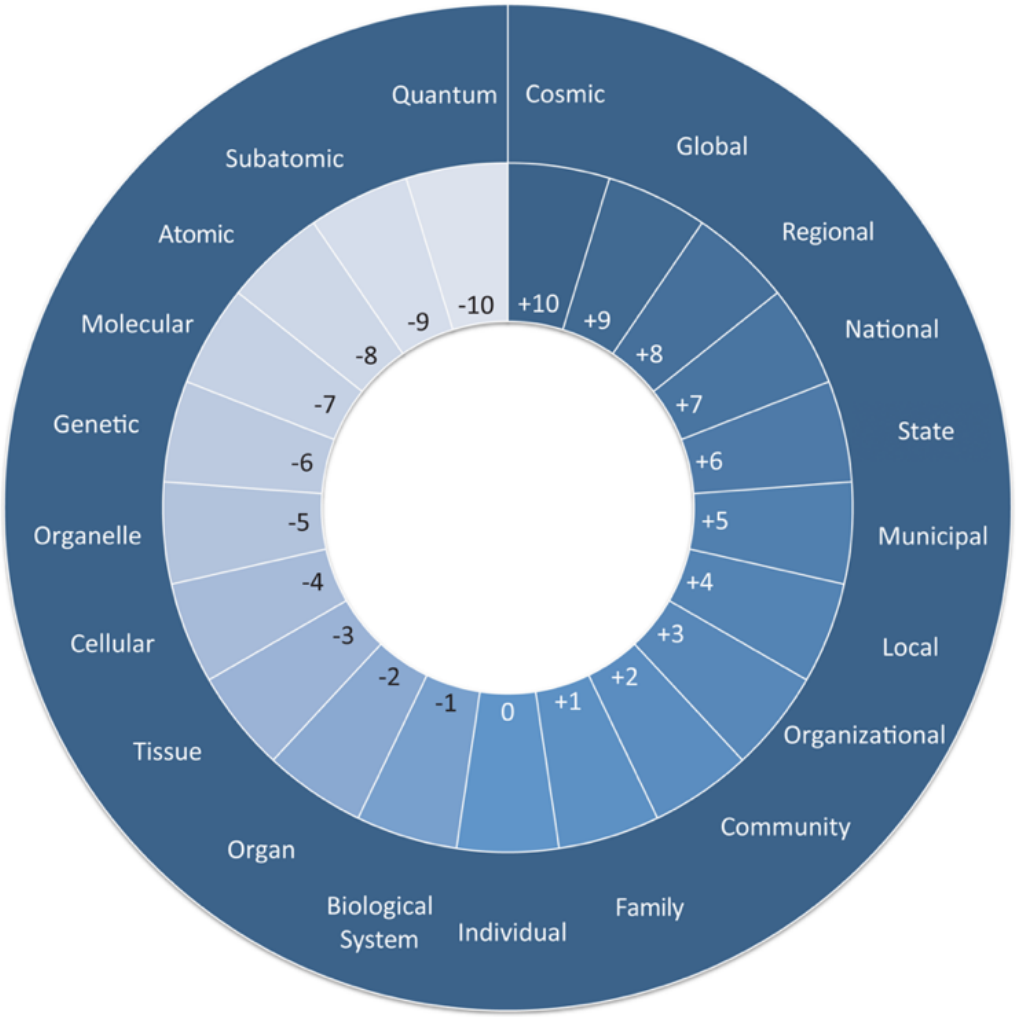
The Outlaw Problem Index (OPI), a categorical system that ranges from the infinitesimally small to the infinitely large, is based upon the 'level' on which disciplines and professions potentially operate. This draws from the concept of a compositional containment hierarchy, a system made up of a hierarchical system of parts.

While disciplines organize knowledge and professions organize people, there is no known way of categorizing problems. To create the problem taxonomy, a hierarchical model was created that ranges from the infinitesimally small to the infinitely large. Using the disciplinary silos outlined by Turnbull and Choi (34, 57), a list of levels was inductively created based upon the levels in which the disciplines might potentially operate. To create the Outlaw Problem Index, the disciplinary continuum was divided into twenty-one slices. Each slice was given a numerical number ranging from -10 to +10. Each quantitative level is named based upon the levels on which disciplines work with -10 being the quantum level, 0 being the individual level, and +10 being the cosmic level. The other 19 levels were populated. The delineation of the problem categorization continuum labels/values were validated based upon feedback from six professionals, from the natural sciences, the health sciences, social sciences, engineering sciences, management, and from the humanities.

The Outlaw Problem Index

The Outlaw Problem-Index divides careers into twenty-one levels with each level given a numerical rating (from -10 to +10). The levels of the index are defined as: Quantum (- 10), Sub-Atomic (-9), Atomic (-8), Molecular (-7), Genetic (-6), Macro-Molecular (-5), Cellular (-4), Tissue (-3), Organ (-2), Biological System (-1), Individual (0), Familial (+1), Community (+2), Organizational (+3), Local (+4), Municipal- City/Town (+5), State (+6), National (+7), Regional (+8), Global (+9), Cosmic (+10), see Figure 11 for the Outlaw Problem Index.

Figure 11: Outlaw Problem Index



Methods

To test the Outlaw Problem Index, we asked oral health professionals to categorize their work using the index in the Interconnections Survey (see specific aim 1 for the complete methods). Using a snowball sampling approach, 23 oral health professionals across disciplines, professions, institutions and sectors were individually interviewed about their current work. Interviews were conducted using a semi-structured interview guide. Participants were asked to define their work according to a problem it addresses. After the interview, each participant was sent a survey to complete which included a request to categorize the level(s) on which the problem they work to address operates using the OPI. They were asked to select all that applied. They were given the image in Figure 11 to help visualize all of the possibilities as well as the below checklist, where they marked their answers.

Figure 12: Outlaw Problem Index - Categorization of Work Prompt

On which categories is your work focused?
We have created a hierarchical categorization system to organize the level in which work operates. Check all that apply.

- ☐ 10+ Cosmic
- ☐ 9+ Global
- ☐ 8+ Regional
- ☐ 7+ National
- ☐ 6+ State
- ☐ 5+ Municipal (city/town)
- ☐ 4+ Local
- ☐ 3+ Organizational
- ☐ 2+ Community
- ☐ 1+ Familial
- ☐ 0 Individual
- ☐ -1 Biological System
- ☐ -2 Organ
- ☐ -3 Tissue
- ☐ -4 Cellular
- ☐ -5 Macro Molecular
- ☐ -6 Genetic
- ☐ -7 Molecular
- ☐ -8 Atomic
- ☐ -9 Subatomic
- ☐ -10 Quantum

Results

Of the 23 participants, 100% were able to define their work according to a problem it addresses. Twenty participants (87%) responded to the question categorizing their work on the OPI. 100% of them categorized their work using the OPI. The mean number of levels selected from the OPI was six (range: 1-14 indices selected). The levels of the index that were chosen by participants most often were: Community Level (n=15), Organizational Level (n=14), and the National Level (n=12).

Conclusion

Despite the profession and discipline, oral health professionals address problems on a variety of levels from the molecular up through the global. The Outlaw Problem Index can be used to inform students, academic advisers, and the general public of the various levels on which professionals address problems, in oral health and in general work-arenas. This paradigm can help people move beyond the silo mentality by helping them to consider working on a problem of concern on a level that resonates with their curiosity, exposing them to new career possibilities.

Specific Aim 4: Publish Problem-Based Digital Stories That Highlight The Problems Oral Health Professionals Work To Address

The Development of Oral-Health.org

The fourth specific aim of this thesis was to publish professional pathways digital stories that highlight the diversity of professional pathways in oral health. To achieve this, http://oral-health.org was purchased from a domain registry in 2015. Oral-Health.org was chosen because the name can encompass all corners of the field without being confined to words that are derivations of the word root *dent* (dental, dentistry, tooth, teeth, etc.). Oral-Health.org is globally accessible and is compatible with personal computers, laptops, tablets, and cell phones. The website's content is presented in American English; future content sourced from other languages will be presented in the local language and in English. The site is managed by the Institute for Interdisciplinary Innovation, a project-based organization that supports people and projects that are focused on solving problems we face in society. The logo has 12 multi-colored segments, which represent isolated 'silos' that come together (the outer unified ring) to address world problems (symbolized by the globe in the middle). The name The Realm of Oral Health was chosen because it will become part of The Realm of Possibility, a broader career exploration system.

Figure 13: The Realm of Oral Health Logo

Website Overview

A space background was chosen for the site to invoke a sentiment of infinite possibilities. A neutral white content area is a standard choice in web development as it allows the reader to focus on the content. The front page was created to as a singular page so the user of the site can find all of the latest pieces of content without having to search the site. This will nudge them to explore the content with minimal frustration. The top of the page begins with the heading, “Oral Health is Everybody’s Business” and includes a blurb introducing the site and a place for people to add add their e-mail address to the contact list (see Figure 14).

Figure 14: Oral-Health.org Webpage - Introduction

The next section, “Explore The Possibilities in Oral Health” explains the three types of Possibility profiles offered on the website including Professional Pathways Profiles, Experience Exchange Profiles, and profiles focused on Academics, Research, and Teaching (see Figure 15).

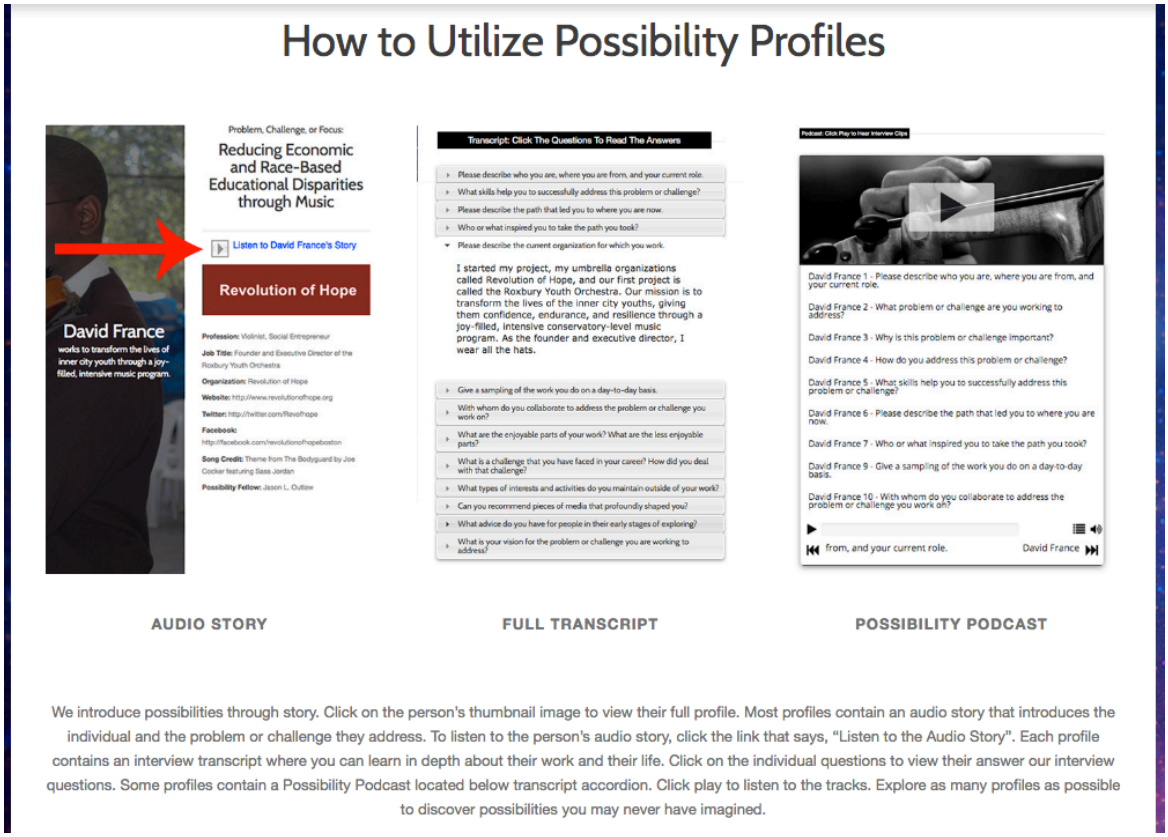
Figure 15: Website Value Proposition

Next, comes the directions on “How To Utilize Possibility Profiles (see Figure 16). This is essential to educate people on how to use the content on the website. Below the directions are the latest Experience Exchange Possibility Profiles which highlight the ways in which people have gotten real-world experience in oral health, oriented around the problem they worked to address in their internship, volunteer position, externship or job. The latest Professional Pathways Profiles then showcase more seasoned professionals in oral health across disciplines and professions (see Figure 17). The page ends with “Professional Pathways Beyond Oral Health” so that users of the

website can encounter the profiles of problems beyond oral health that might spark their interest in allied fields.

The site is flexible enough to feature other types of profiles that can be developed as we discover new opportunities for engagement of people around oral health. Some of these potential profiles include Institutions of Impact Profiles, which are centered on the problems that specific institutions are addressing.

Figure 16: How To Utilize Possibility Profiles



Latest Professional Pathways Profiles in Oral Health

The next section of the front page features the latest Professional Pathways Profiles in Oral Health. These profiles were developed using the Professional Pathways Interview Guide and the Interconnections Survey. Each survey was recorded, transcribed, copy edited, and sent to the original interviewee for review before publication. Each participant submitted pictures to complete their profiles.

Figure 17: Thumbnails for Professional Pathways Profiles

Components of a Possibility Digital Story

Possibility profiles feature established individuals across professions and disciplines to highlight the story behind their resume. They are categorized according to the problem they work to address.

- Audio Story: This brief audio clip uses storytelling to highlight the importance of the problem they work to address through their career.

- Professional Affiliations: Meta-data that categorize the interviewee are included on the possibility profile. This includes their job title, profession, and affiliation.

- Interview Transcript: The entire interview is transcribed and edited for readability so that people can read the contents of the interview in full-text whenever they like.

- Possibility Podcast: The edited interview is cut into individual audio clips so that people who would like to hear the entire interview can do so at their leisure.

See Appendix F for images of a completed Professional Pathways Profile.

Dimensions of Possibility Profiles

I used an agile approach to fine-tune the questions that populated the content for the Possibility Profiles. I learned that the goal of listening to a Possibility Profile should be akin to "picking the brain" of the interviewee as though the consumer of the web-content were meeting them face-to-face in a robust informational interview. I created a framework that determines the type of content that should be covered in a Possibility Profile to elicit sufficient depth to humanize the person being featured; see Figure 18 for the graphic depicting the Dimensions of the Possibility Profiles. Each profile will elicit information on the following layers:

Figure 18: Dimensions of a Possibility Profile

Each dimension of a Possibility Profile leads to one or more questions that the interviewees are asked in the Professional Pathways Interview Guide (see Appendix C for the Guide). The thinking behind each dimension of a Possibility Profile is described below.

1) **Problem**. We ask each participant about the problem they work to address. We also ask them why this problem is important. These questions shift the conversation toward a problem-based paradigm for exploration and give the student a starting point for their own active exploration of the problem.

2) **Skills**. It is not always obvious what skills people need to be successful in their role; this includes both hard and soft skills.

3) **Exploration**. Many of the possibilities that exist are obscured by our experiences, so we help students to take an active approach toward exploring the possibilities – to maximize serendipity. This set of questions exposes students to media and resources that will help them explore the problem the interviewee is addressing. We also include content that exposes students to media and resources that simply had a profound effect on them so that students can consult some of these resources on their own. The exploration layer also gives the student more advice for those who are early in their path of exploration.

4) **Individual Pathway**. Many students believe that there is a liner path between choosing a path of study and the ultimate destination where someone lands. This is no longer the case. Understand the dynamism of peoples' paths will help students to understand that they must be prepared to change course, and be comfortable with the uncertainty that comes with building a future for oneself. We showcase the unique path of each individual and allow them to explain the most important milestones that shaped their lives. Frequently, successful people are seen as infallible, and the soft skills of grit and resilience are not obvious based upon a person's resume. Grit is being recognized as an essential component in the character profile of successful people. "Grit entails working strenuously toward challenges, maintaining effort and interest over years despite failure, adversity, and plateaus in progress." (58). The stories that people tell are wide reaching. In a possibility profile, the interviewee is asked, "*What is an obstacle that you faced in your career? How did you deal with that obstacle?*" When exposed to multiple answers to this question from different people, the reader/listener learns that most people have challenges in their careers. This introduces explorers to the stories of how people overcome challenges, insight that is often absent when discussing the work that people do in their careers.

5) **Inspiration**. We capture directly the sources of inspiration in the interviewee's life so that students can open their minds toward the non-obvious fountains of inspiration not limited to events, people, experiences, and failures.

6) **Work Profile**. The nature of work is evolving every day. Work-styles that were considered to be non-traditional are becoming more mainstream. Also, people may be working on similar problems or in congruent jobs, but may have radically different work structures day-to-day. These questions help students to grasp the new-normal and understand what the interviewee enjoys and dislikes about their work. We also attempt to underscore what types of things the person does outside of work to maintain work-life balance.

7) **Value Creation**. As we enter a 'job-less economy' the language around 'getting a job' is beginning to switch toward the language of 'creating value'. Value creation is a much broader notion and the beneficiary is not limited to an employer, but can be an institution, a community, or your very own venture.

8) **Collaboration**. The nature of work is increasingly interdisciplinary, interprofessional, cross-sectoral, and done in teams that are not necessarily geographically co-located. The stakeholders for problem-solving are not always obvious, and there may be opportunities for students to explore the careers and pathways of professionals who collaborate to address specific problems of concern.

9) **Future Vision**. One of the missing parts of compulsory education in the United States is the notion of vision. We specifically request our interviewees to project a vision for the future as it relates to the problem they are working to address, and to posit how get there. With this

insight, perhaps, students will begin to create their own visions for the problems they would like address in the future.

10) **Principles**. It is hard to get a sense of someone's values or principles unless you happen to get to know them personally. Because our interviews often last more than an hour, we ask them to describe a principle or value they use to navigate their life. This adds depth to our understanding of them, and introduces an opportunity for students to consider which principles and values they would like to live by so that they may draw from them as the proceed through their education, career, and life.

11) **Education**. In the 21st century, education has become a multidimensional endeavor including analog and digital infrastructure, formal and informal information that has been unleashed by new forms of connectivity. We ask the participants to describe how their formal an informal education has impacted them to allow students to gauge how education has helped to shape the careers of the participants.

12) **Happiness**. The things that make people happy are not always obvious. By asking a direct question about what brings the participant joy and happiness, students can discover what make people happy, which may be different than what they imagined.

Discussion

The Professional Pathways interview is but one type of profile to help people to understand the career possibilities. Other uses include:

1. Experience Exchange profiles that help students to understand how people gained their early work experiences in the field, and the problems they worked on in the process.

2. Labor of Love profiles that help people who have only seen a world of white-collar professionals the stories of the working class and the problems they work to address in their roles.

3. Creating Change profiles focus on advocates who do focused work on improving society through their focused work on a specific problem.

4. Advancing the Arts profiles focus on individuals who work within the arts and helps to highlight the problems they address through their work.

Each type of Possibility Profile will have different questions, but all will draw from the Dimensions of a possibility profile to paint a 3-dimensional, multifaceted understanding of the individual through their digital story.

Conclusion

Oral-Health.org is a website that can be used world-wide to generate new and sustained interest in addressing the problems we face in global oral health.

General Conclusion for Overall Thesis

Our society is in need of a critical mass of people addressing the emerging and longstanding problems we face. If we want to cultivate a culture of people who are invested in addressing and solving these problems, we have the opportunity to frame our work and needs as problems. This thesis demonstrates:

Specific Aim 1a: Oral health professionals across disciplines and professions can frame their work as a problem they work to address.

Specific Aim 1b: Keywords add context and nuance to the description of the problems oral health professionals work to address, and interlink problems in a network.

Specific Aim 2: Problem networks allow the visualization of less-than-obvious interconnections between people who address similar problems from different disciplinary and professional fields.

Specific Aim 3: The Outlaw Problem Index uses a categorization system that categorically and numerically classifies problems which can be used to help people discover problems, careers, and digital stories that engage on specific levels on the problem index

Specific Aim 4: Oral-health.org is a viable way to use digital stories to highlight the problems oral health professionals work to address and can be used world-wide to generate new and sustained interest in addressing the problems we face in global oral health.

The purpose of this work was to create digital stories that encouraged students to explore unimagined careers, that is, to explore the "Unknown Unknowns" and to translate them into "Known Knowns" through deliberate exploration. As the working world and the academic world hyper-specialize, the common thread linking people across different domains are the problems that they solve. Problem solving sparks generative thinking; forcing people to look forward, to create, and to put forth emotional labor, while bringing out the gifts that make us human. Organizing such a distribution system could be achieved through Problem-Based Career Exploration.

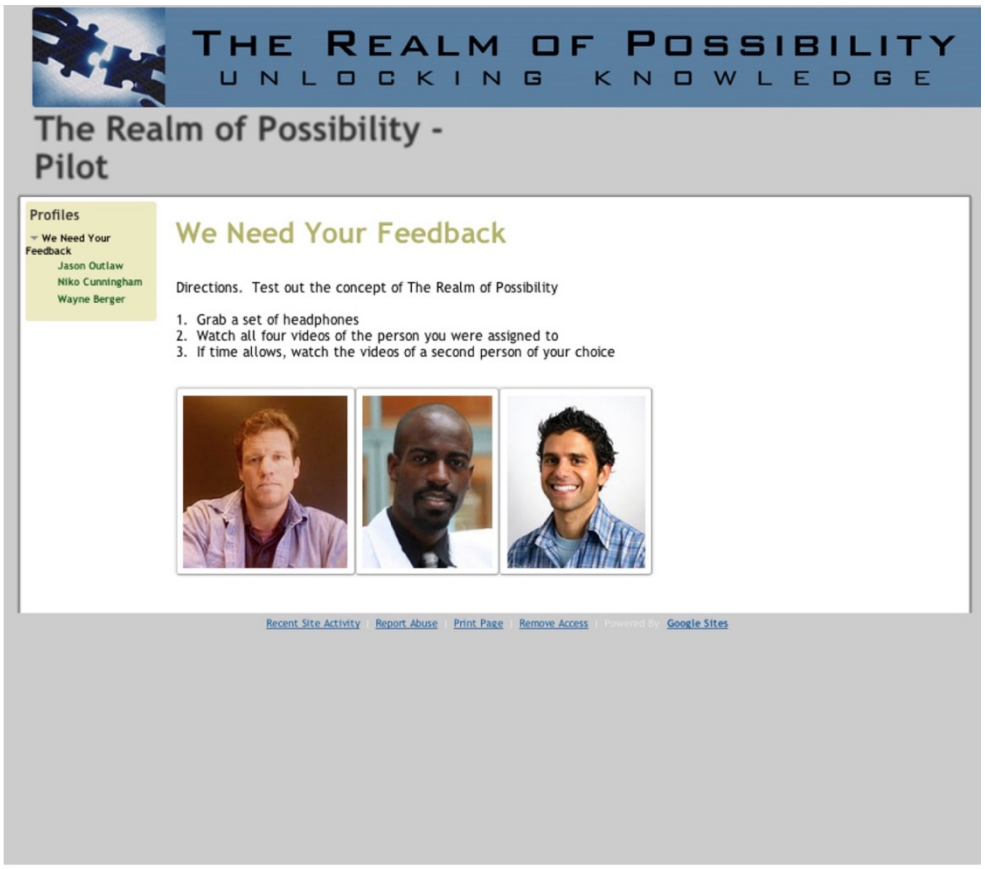
Institutions are central in implementing a problem-based paradigm for careers. Institutions of primary education, secondary education, and institutions of higher education have the opportunity to show how disciplines and professions, and individuals leverage their skills to make an impact in the world. This can be achieved by the following: 1) asking students to choose a problem of interest in their application for matriculation; 2) catalog the problems faced in your respective field/discipline/profession; 3) Publically and periodically immerse the students and administration in language and action related to the problems you wish to prioritize; and 3) require students and administrators to declare a problem they would like them to understand and address.

Problem-Based Career Exploration is universal and obeys no boundaries. It can be implemented in any field to help students and the public to gain exposure to new career possibilities and new problems as they emerge. Problem-Based Exploration has the promise to build a critical mass of people who have oriented their careers around addressing the problems we face in society.

Appendix A: The Realm of Possibility Pilot Interface

Figure A-19: Pilot Interface

The first rudimentary version of The Realm of Possibility was created using a Google Sites Wiki page, and it provided directions for the group of participants.

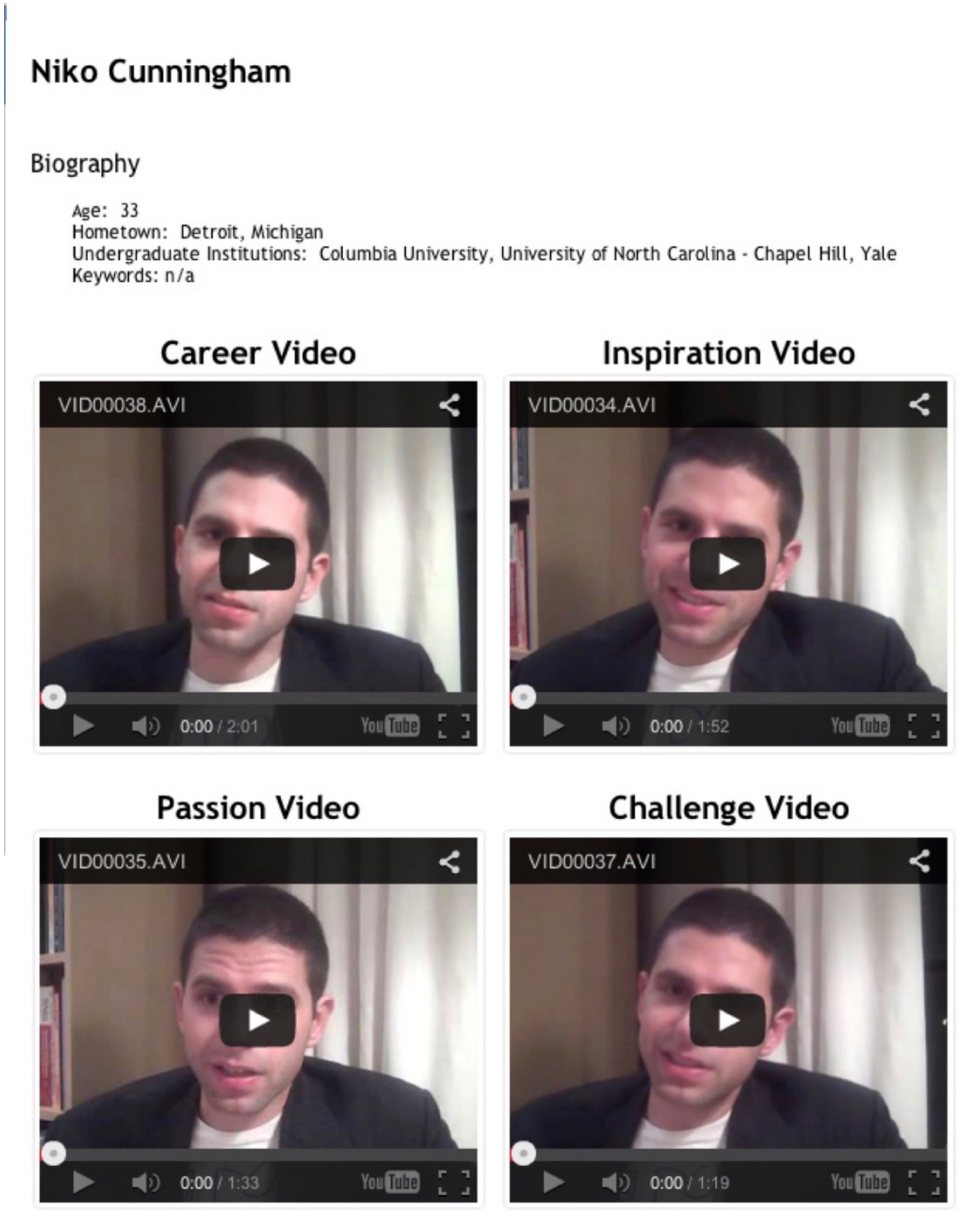


Consider the following questions and click on link to the feedback page:
http://spreadsheets.google.com/viewform?formkey=dE5nMmNsQ2cyZlQwRkFOWWszMFcxd3c6MA

1. What can we do to improve this concept?
2. What biographical information should be included on each person?
3. How long do you thing the videos should be?
4. Can you think of other useful content that should be included on each person's profile?
5. Can you offer any other general suggestions?

Figure A-20: Video Profile Page

This profile page includes the four videos of the interviewee answering questions about their career, the inspiration behind their career choice, something they are passionate about, and a story demonstrating how they navigated a challenge in their work / life.



Appendix B: Interconnections Survey

The interconnections survey was developed to collect categorization and demographic information for Realm of Possibility Profiles. IRB approval was obtained to use this survey to collect demographic data in the specific aims. The following survey was sent to participants after they completed their Professional Pathways Interview.

Interconnections Survey

Survey for the Professional Pathways Profiles

You are free to skip any of the questions that you do not want to answer. All of the answers provided will help us to create a rich profile and to make it possible for people to search for people who have diverse life experiences.

* Required

Contact Information

1. **What is the correct spelling of your full name?** *
   This question will ensure that your name is properly spelled on your profile. Please include a title like Dr. if applicable.

2. **What is your email address?** *
   This will allow us to send you your completed profile for your final review before it is published. Your e-mail address will NOT be made public.

3. **Where are you geographically located?**
   City, State/Province, Country

4. **Where are you from originally?**
   City, state/province, and country. We ask this question so that people who grew up in the same geographic area as you did may gain inspiration from your profile. You may omit the city if you like.

5. **What is the address of your website?**
   If you have a website that you would like to share on your profile, please list it below.

6. **What is the address of your blog?**
   If you would like to share a link to your blog, please list it below.

7. **What is your instagram page?**
   If you would like to share your instagram page, please list it below.

8. **What is your twitter address?**
   If you would like to share your twitter page, please list it below.

9. **If you would like to share any other social media pages, please list them below.**

Educational Information

10. **Please list all of your undergraduate majors** *
    If you had more than one please list them all.

11. **What were your undergraduate minors?**

12. **What did you study in graduate school?**
    If you have multiple areas of study, please list them all.

13. **Please list all of the degrees you have obtained.**

14. **What other formal education have your received?**

15. **What other informal education have your received?**

Professional Categorizations

16. **What is your current profession?** *

A profession is a vocation founded upon specialized educational training. If you have more than one profession, please list them all.

17. **What is your speciality within your profession?**

Optional

18. **What is your current job title?**

If you have more than one role, please list them all.

19. **Who is your current employer?**

If you have more than one, please list them all.

20. **In which sector do you work?**

Please select the answers as they apply to your work.
Check all that apply.

- [ ] Academia
- [ ] Administration and Support
- [ ] Arts, Entertainment and Recreation
- [ ] Big Business
- [ ] Construction
- [ ] Educational Services
- [ ] Entrepreneurship
- [ ] Finance & Insurance
- [ ] Government
- [ ] Healthcare
- [ ] Information
- [ ] Management
- [ ] Manufacturing
- [ ] Mining
- [ ] Non-Profit
- [ ] Primary or Secondary Education
- [ ] Professional & Scientific Services
- [ ] Real Estate
- [ ] Research
- [ ] Retail Trade
- [ ] Small Business
- [ ] Social Assistance
- [ ] Social Entrepreneurship
- [ ] Startup
- [ ] Transportation & Warehousing
- [ ] Utilities
- [ ] Waste Management
- [ ] Wholesale Trade
- [ ] Other: .....

21. **In which stage of your career are you?** *
Mark only one oval.

- ◯ In Training
- ◯ Early-career
- ◯ Mid-career
- ◯ Late-career
- ◯ Retired

22. **Do you consider yourself to be a career changer?**
Mark only one oval.

- ◯ Yes
- ◯ No

23. **If you are indeed a career changer what was your previous profession?**
If you have more than one, please list them all.

.....

.....

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.....

Categorizing the Problem You Work to Address

Below is a graphic that attempts to divide the problems people work to address into discreet categories. We would like you to determine where on the continuum the problem or challenge you work fits in.

24. **On which categories is your work focused?**

We have created a hierarchical categorization system to organize the level in which work operates. Check all that apply.
Check all that apply.

- [ ] 10+ Cosmic
- [ ] 9+ Global
- [ ] 8+ Regional
- [ ] 7+ National
- [ ] 6+ Provincial
- [ ] 5+ Municipal
- [ ] 4+ Local
- [ ] 3+ Organizational
- [ ] 2+ Community
- [ ] 1+ Familial
- [ ] 0 Individual
- [ ] -1 Biological System
- [ ] -2 Organ
- [ ] -3 Tissue
- [ ] -4 Cellular
- [ ] -5 Macro Molecular
- [ ] -6 Genetic
- [ ] -7 Molecular
- [ ] -8 Atomic
- [ ] -9 Subatomic
- [ ] -10 Quantum

25. **Who are the stakeholders in the problem you work to address?**

List as many groups and constituents as you can. Use commas to separate the stakeholders you list.

26. **Which professions must be involved to solve the problem you are working to address?**
List as many professions as you can. Use commas to separate the professions you list. (A profession is defined as a paid occupation, especially one that involves prolonged training and a formal qualification.)

.....

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.....

27. **Which disciplines must be involved to solve the problem you are working to address?**
List as many disciplines as you can. Use commas to separate the professions you list. (A discipline branch of knowledge, typically one studied in higher education, e.g. sociology, immunology, history, etc.)

.....

.....

.....

.....

.....

28. **What type of entrepreneur are you?**
Mark only one oval.

- ◯ I do not consider myself to be an entrepreneur.
- ◯ Small Business Entrepreneur
- ◯ Large Business Entrepreneur
- ◯ Scaleable Startup Entrepreneur
- ◯ Social Entrepreneur
- ◯ Other: .....

Diversity & Inclusion

This section includes questions to help people gain inspiration from individuals who are similar or different from themselves.

29. **What is your gender identity?**
Mark only one oval.

- ◯ Female
- ◯ Transgender
- ◯ Male
- ◯ I prefer to skip this question
- ◯ Other: .....

30. **How would you classify your race?**

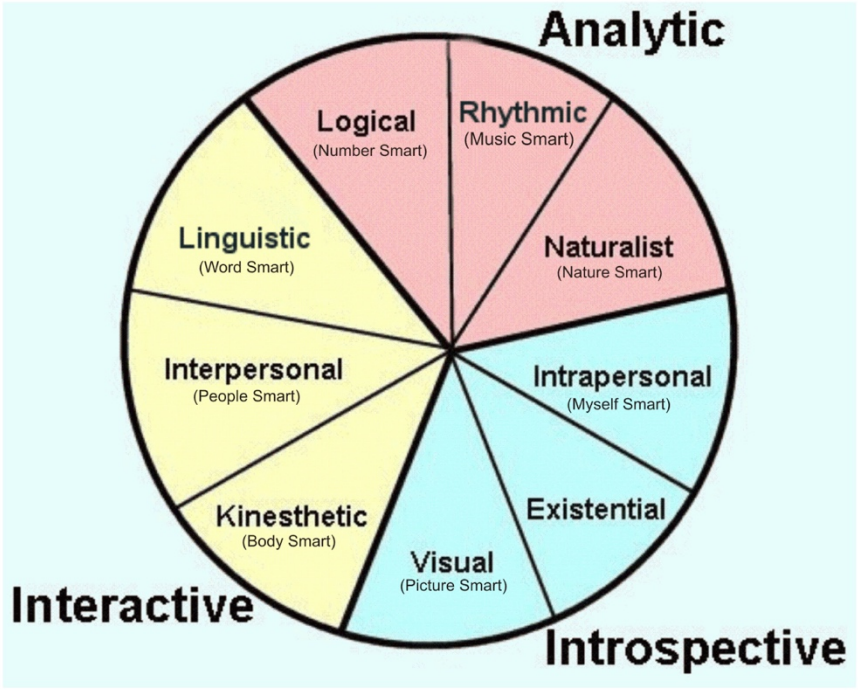
31. **How would you classify your ethnicity?**

32. **Which of the following would you choose to describe your upbringing?**
Check all that apply.

- [ ] Upper Class
- [ ] Upper Middle Class
- [ ] Middle Class
- [ ] Lower Middle Class
- [ ] Working Class
- [ ] Poor
- [ ] Homeless
- [ ] I prefer to skip this question
- [ ] Other:

33. **Where are you on the political spectrum?**
For example, would you consider yourself far-left wing, right wing, or more in the center?
Mark only one oval.

	1	2	3	4	5	
Left	◯	◯	◯	◯	◯	Right



34. **Which of the following learning styles are strongest in you?**
Check all that apply.

- [ ] Logical
- [ ] Rhythmic
- [ ] Naturalist
- [ ] Intrapersonal
- [ ] Existential
- [ ] Visual
- [ ] Kinesthetic
- [ ] Interpersonal
- [ ] Linguistic

35. **Do you have a disability. If so what type?**

36. **What is your sexual orientation?**
Mark only one oval.

- Heterosexual
- Lesbian
- Gay
- Bisexual
- Transgender
- Queer
- I prefer to skip this question
- Other: .....

Appendix C: Professional Pathways Interview Guide

Professional Pathways

http://pathways.therealmofpossibility.org/

The professional pathways profiles on The Realm of Possibility features established individuals across professions and disciplines to highlight the story behind their resume. Instead of organizing people according to the disciplines, professions and specialties that divide us, we organize people according to the problems they address in their roles so that people can understand the ways in which people use their work to make their organization and the world a better place. This paradigm is called Problem Based Career Exploration and was pioneered by our team here at The Realm of Possibility.

Frequently Asked Questions

1. How is this interview going to be used?

Answer: All of the interviews for The Realm of Possibility will be made publicly available on our website. Music will be added to your audio story. Your interview will be transcribed and your audio will be separated into separate audio tracks. Example: http://professionals.therealmofpossibility.org

2. How are Experience Exchange and Professional Pathways profiles different?

Answer: Professional Pathways profiles showcase established professionals who are reflecting back over their career. Experience Exchange profiles showcase students, recent grads, and early stage professionals who are still gaining experience. We focus on one specific role like an internship, research position, job, volunteer position, entrepreneurial endeavor, or beyond. You can find the question that we ask in the Experience Exchange profiles (the other type) here: http://experience.therealmofpossibility.org

3. How should I prepare for an interview?

Answer: The best way to prepare for an interview is to read through the questions found on the pages below. Be sure to read the small print written below the question prompts which were written to explain the questions more deeply. While some interviewees take notes, avoid reading a prepared response. Speak from the heart and use stories to communicate your message. Capturing your authentic voice and your unique path is the central purpose of this site.

4. Why do you ask me to repeat the question before I give my answer?

Answer: We ask that you repeat the question so that listeners will understand which question you are answering.

5. I use a great deal of conversation fillers like *ummmm*, in my speech, and I don't like the way I sound....

Answer: Our professional editor is trained to make you sound great! We take the time and effort to make each audio track sound great. We will edit out an over-abundance of conversation fillers.

6. Some of these questions do not apply to me. Can I skip certain questions? Can I restart my answer to a question?

Answer: Every question will not apply to everybody. Also there may be questions that you are not comfortable answering. During the interview you simply say that you want to skip a question and we will move on to the next question. If you would like to restart your answer to a question, just indicate this verbally during your interview. If you would like to cut out the sentence you just stated, just indicate that you would like the sentence to be removed, and the audio editor will remove it during her review.

7. What other information will you need from me to complete my Possibility Profile?

Answer: We will send you an email requesting a profile picture, an action picture of you for the audio player widget, and a logo. We will also send you a brief survey for your to complete to categorize your profile.

8. Will I have an opportunity to see the final product before it is published?

Answer: After your audio file has been edited, it will also be transcribed and edited to read like prose. We will combine the pictures you send to us with the content of the interview to make a complete profile. We will send it to you for your approval.

Profile Interview Questions

Please prepare to answer the following questions which will be used to build a complete profile on you. Some of the questions have background information in parenthesis to guide your response. The interview will be recorded, and it will be conducted in a quiet space to aid in transcription. A full podcast of the interview will be available on the website, and it will be edited to ensure the greatest possible presentation of you. Please answer the questions with complete sentences and try to make your responses as conversational as possible. Avoid using dates so that the profiles do not become dated over time. The use of personal stories that paint pictures in people's minds is more powerful that facts alone. Before the profile is published, it will be sent to you for review.

Note: During this part of the interview, repeat the question so that the audio editor will know exactly which question you are answering and so that listeners of the podcast will know which question you are answering.

Part I: Extended Profile Questions

0. State your name, the date and state: this is Professional Pathways for The Realm of Possibility
1. Please describe who you are, where you are from, and your current role. **(repeat the question)**

   (Begin with your name, and describe the job or role that you currently have. If you have more than one, feel free to describe more than one.)
2. What problem are you currently working to address? **(repeat the question)**

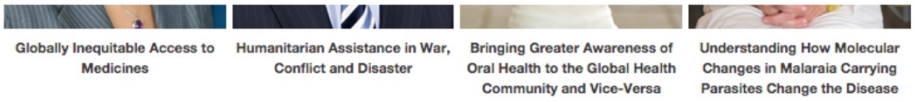
   (We organize people on The Realm of Possibility according to the problem they address. If you are working on more than one problem, choose one, and keep that one in mind as you proceed through the interview. If you find it difficult to characterize your work in terms of a problem, try to think about the problem that organization for which you work addresses.)

   (the following question below will serve as the TITLE of your profile)

2-TITLE. To create a title for your profile, reduce the description of the problem you work to address down to 12 words or less. **(repeat the question)**

(You response will serve as the title for your profile and will allow users to find people from other professions and disciplines working on a similar problem; try not to make it longer than 12 words.)

The following are examples:



2-ASSESSMENT. What difficulties did you found in describing your work as a problem that you are working to address? **(repeat the question)**

(This question helps to gauge the usefulness of organizing people according to the problem they work to address in their role.)

2-KEYWORDS. Please list as many keywords as possible that are associated with the problem you work to address? **(repeat the question)**

(This question helps us to connect your profile to others profiles, especially those working on a similar problem, perhaps through a different field, profession,or discipline. The more keywords you list the better. It will also be used at the beginning of your audio story.)

3. Why is this problem important? **(repeat the question)**

(High school and college students are a large proportion of the audience for these profiles and may not have been exposed to this problem before. This is an opportunity to create a sense of urgency, embody purpose driven-work, and to bring the specific problem you address into perspective.)

4. How do you address this problem? **(repeat the question)**
5. What skills help you to successfully address this problem? **(repeat the question)**

(Often the skills that are valuable in the working world are not exclusively taught in the classroom. Describing relevant skills that make you valuable and indispensable in your work and where you gained them will help students to understand the range of ways in which they may invest in skills that will contribute to their emerging careers.)

6. Please suggest media or resources that will help people explore this problem. **(repeat the question)**

(Please suggest documentaries, books, movies, articles, or any other type of media so that students can begin to investigate this problem.)

7. Please describe the path that led you to where you are now. **(repeat the question)**

(The purpose of this question is to demonstrate that most people do not have linear paths, and that exploration, serendipity, passion, failure, etc., modify, and enhance our paths. Be as detailed as you would like. Include your education, milestones, your first job, internships, experiences, and how your path changed over time. Is this where you expected yourself to be?)

8. Who or what inspired you to take the path you took? **(repeat the question)**
9. Please describe the current organization for which you work. **(repeat the question)**

(Begin with the name of the organization you work for then describe the mission and the ways in which you accomplish your mission.)

10. Give a sampling of the work you do on a day-to-day basis. **(repeat the question)**
11. How did you create value for the organization where you work? **(repeat the question)**

(This can include the day-to-day tasks you performed, as well as the higher level contributions that you made during your experience.)

12. With whom do you collaborate to address the problem you work on? **(repeat the question)**

(Collaboration is at the center of addressing problem solving. This question seeks for you to describe in particular the ways in which you worked with a team, and with people from various disciplines, professions, institutions, levels, etc. to address the problem you address.)

13. What are the enjoyable parts of your work? What are the less enjoyable parts? **(repeat the question)**
14. What is an obstacle that you have faced in your career? How did you deal with that obstacle? **(repeat the question)**
15. What are the ways in which you maintain work-life balance? **(repeat the question)**

(If you find it difficult to maintain work-life balance, please describe why this is in your role..)

16. Can you recommend pieces of media that profoundly shaped you? **(repeat the question)**

(This question helps people to explore things that are meaningful to you - things that inspired you. This may include articles, movies, books, documentaries, etc. Please explain why they impacted you.)

17. What advice do you have for people in their early stages of exploring? **(repeat the question)**

    (As a supplemental question, also address the question, "What would you as an adult tell to the student version of yourself?")

18. What is your vision for the problem you are working to address? How do we get there? **(repeat the question)**

    (This question is a call to action that will help students to think about how you as a professional imagine the future, and helps to concretize how we might achieve that vision. How do you propose we get there?)

19. Please describe a principle or value you embody to navigate your life. **(repeat the question)**

    (Values are often what shape us into the people that we are. Sharing your core values will help the audience to learn about you in the deepest way possible, in a way that is often never discussed.)

20. How did your formal and informal education shape you as a person? **(repeat the question)**
21. What makes you happy? What brings you joy? **(repeat the question)**

Part II: Audio Story Questions

The second part of the interview will be condensed into a short audio clip so that users can hear your voice and be reminded that you are actually a person. This should be no longer than three or four minutes in length. Attempt to transition from one section to the other naturally, as we would like to have this audio story be done in one take without editing out the humanity in your story. Please take a moment to collect your thoughts before this portion.

For this portion of the interview, please do not repeat the questions. Just answer them all in series. This audio story will autoplay in the background when people visit your profile on The Realm of Possibility.

Aim for the entire audio story should no be longer than three minutes.

0. State: this is my audio story (to let the editor know that you are beginning your audio story)

1. Briefly say your name, where you are from, your current role and institution, and introduce the work you do.
2. Tell a brief ***personal story*** that highlights the importance of the problem you working to address through your role, or on how you got involved.

Part III: Referrals

Could you please suggest people for us to interview? We are looking for people who are doing interesting, inspiring, innovative, important work. We are looking for people who are working on important problems and challenges in your field/discipline/profession/specialty .

Appendix D: Problem-Based Oral-Health Network

Figure D-21: Complete Oral Health 2-mode Problem Network

This image represents the complete oral health network with all of the nodes and keywords interlinked into a single graph.

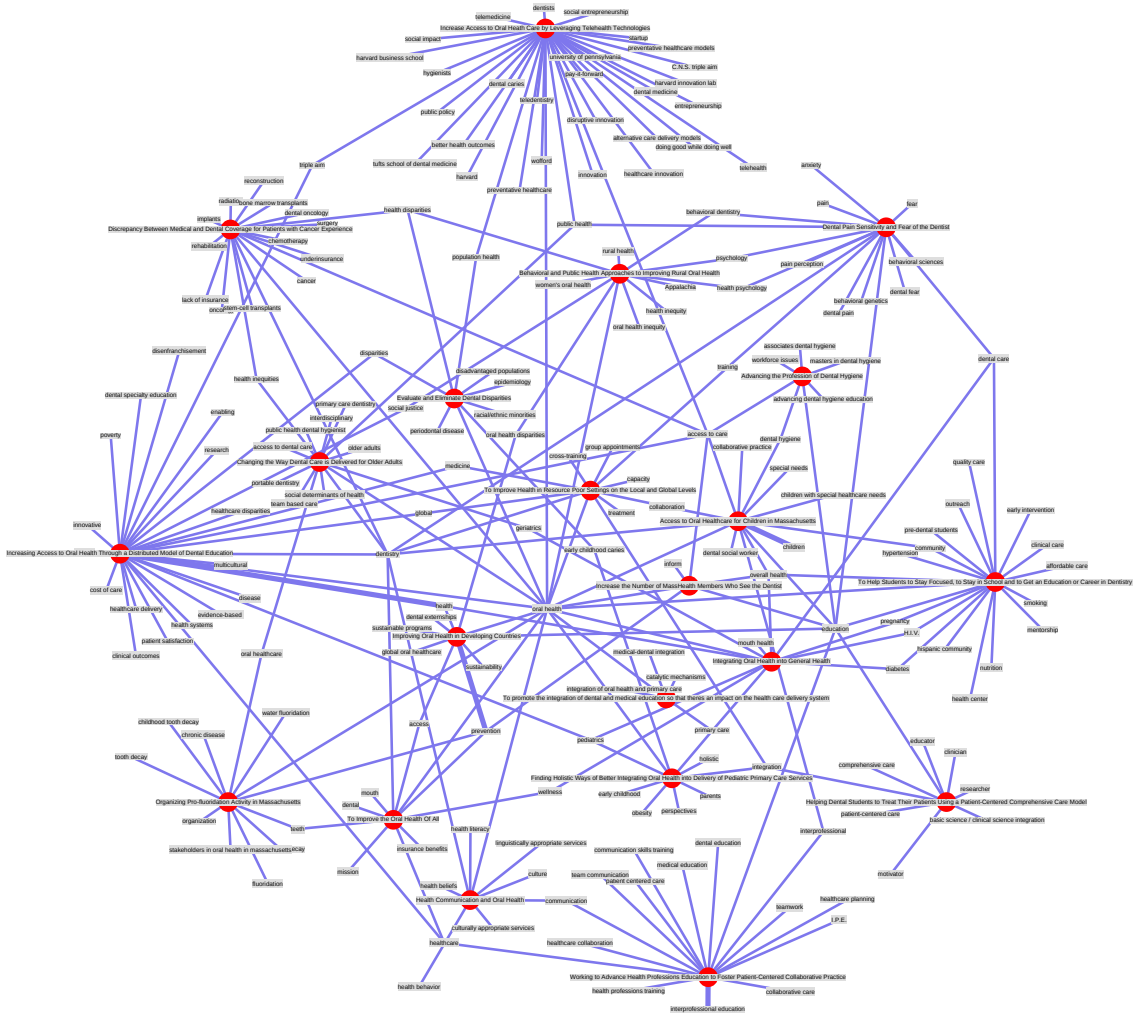


Figure D-22: Problem Network, Zoom 1

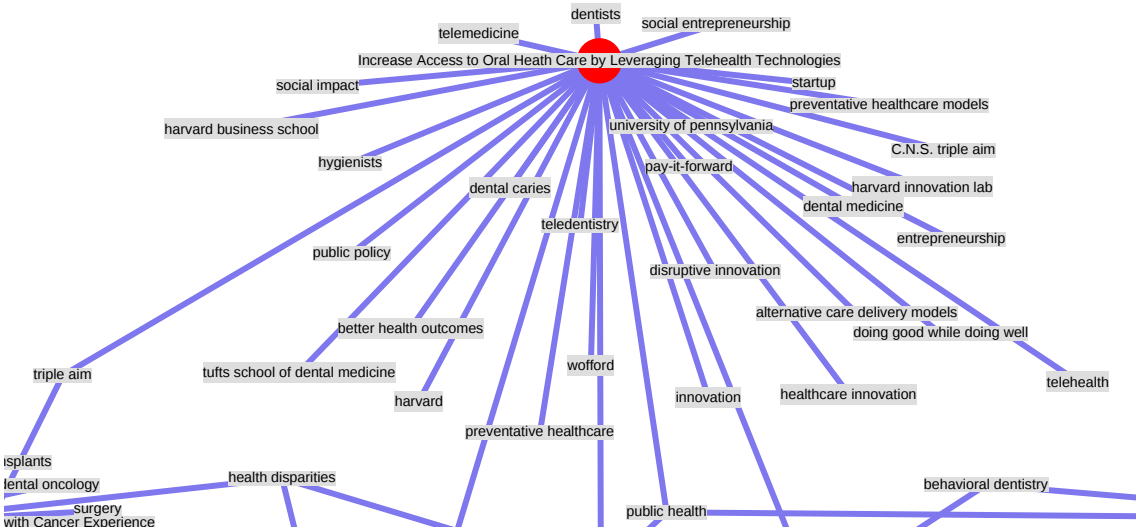


Figure D-23: Problem Network, Zoom 2

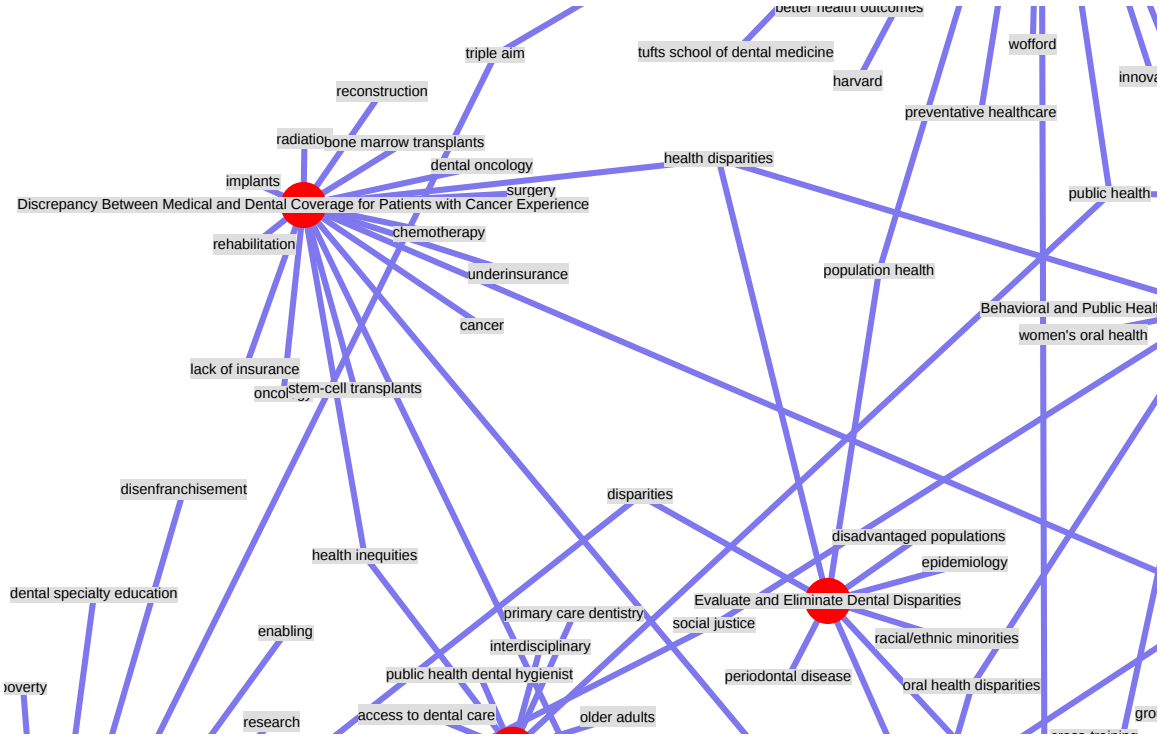


Figure D-24: Problem Network, Zoom 3

Figure D-25: Problem Network, Zoom 4

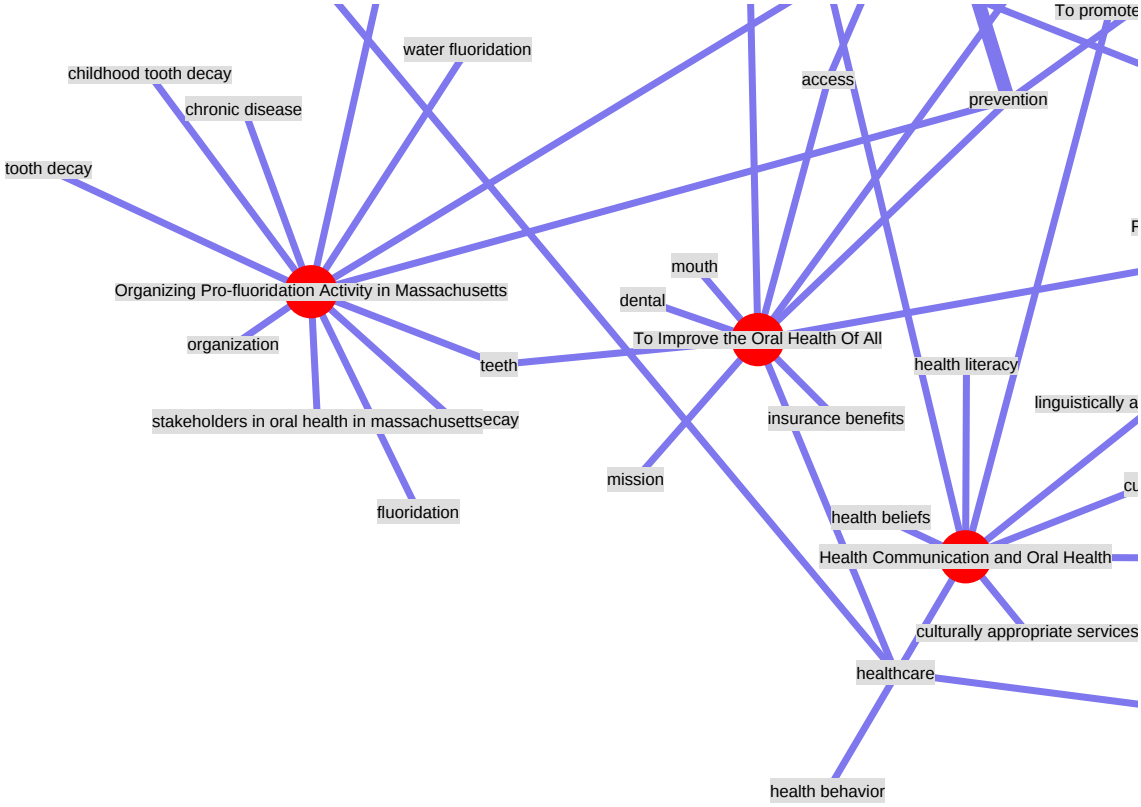


Figure D-26: Problem Network, Zoom 5

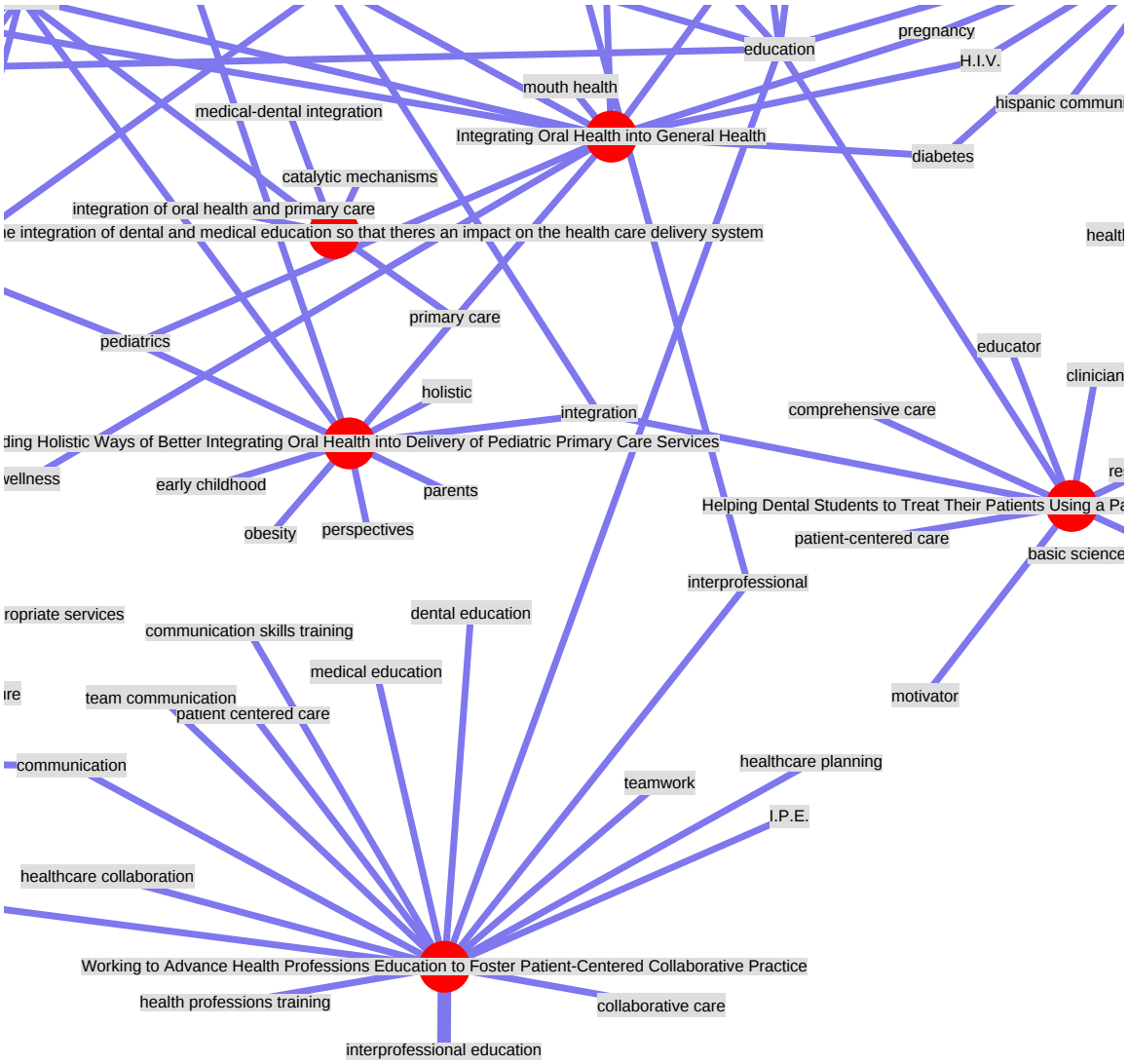


Figure D-27: Problem Network, Zoom 6

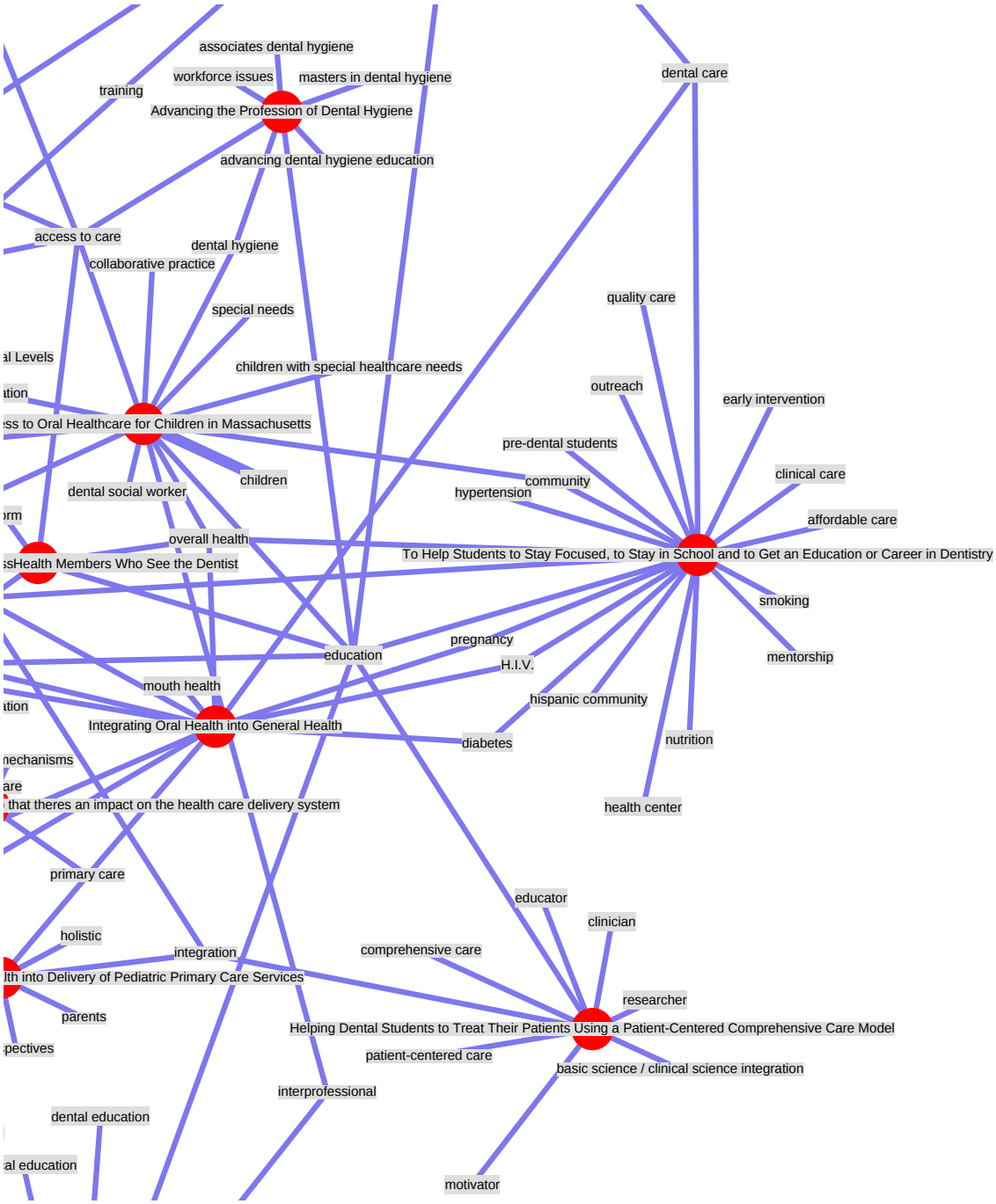


Figure D-28: Problem Network, Zoom 7

Figure D-29: Problem Network, Zoom 8

Appendix E – Oral Health Professions on the Outlaw Problem Index

Figure E-30: Results of Outlaw Problem Index Study

An image showing the count for the number of oral health professionals whose work operates at each level of the Outlaw Problem Index

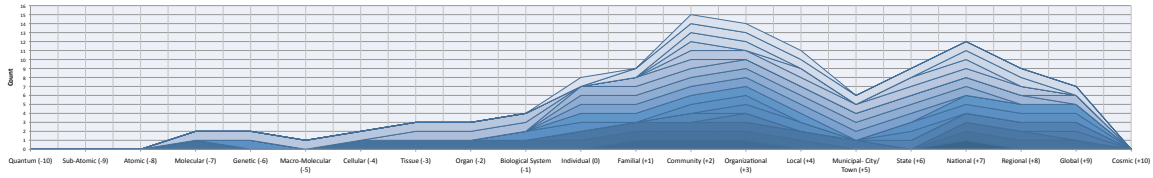


Figure E-31: Outlaw Problem Index Study, Zoom 1

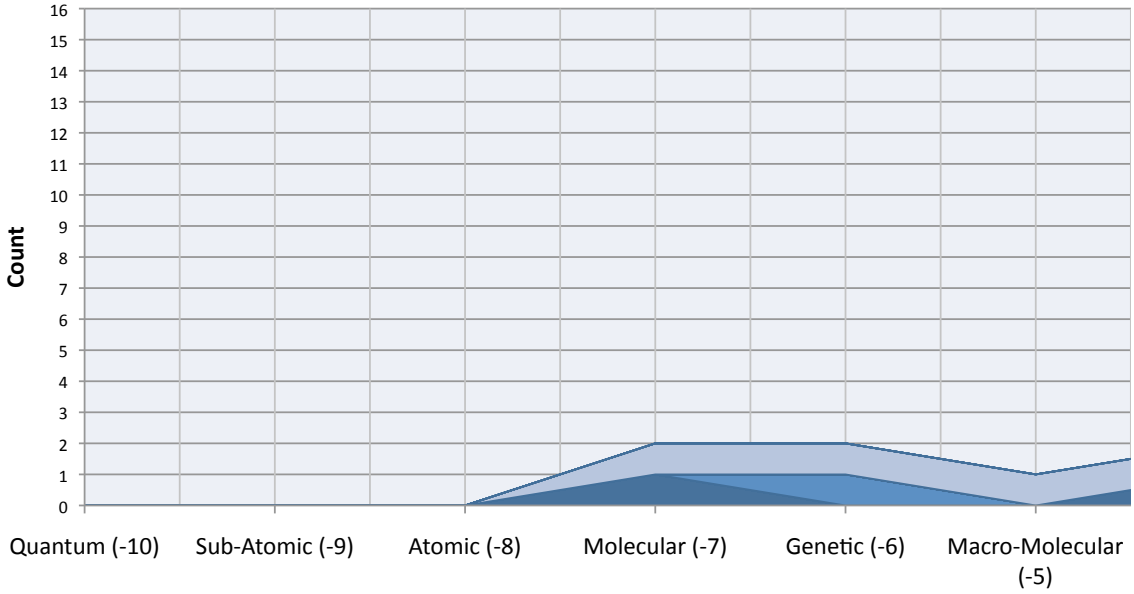


Figure E-32: Outlaw Problem Index Study, Zoom 2

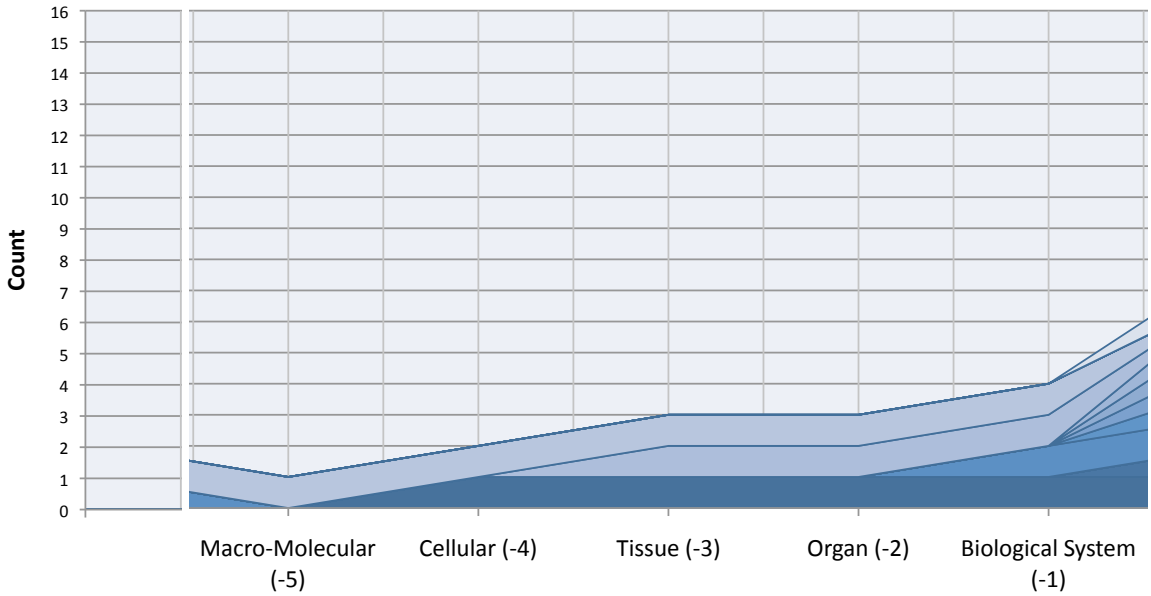


Figure E-33: Outlaw Problem Index Study, Zoom 3

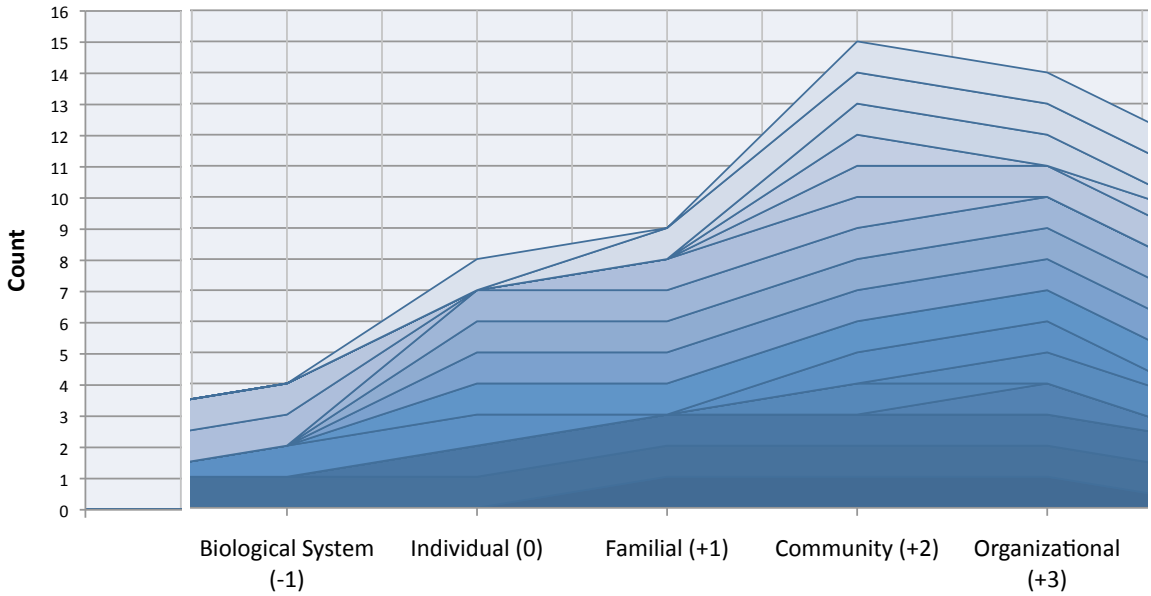


Figure E-34: Outlaw Problem Index Study, Zoom 4

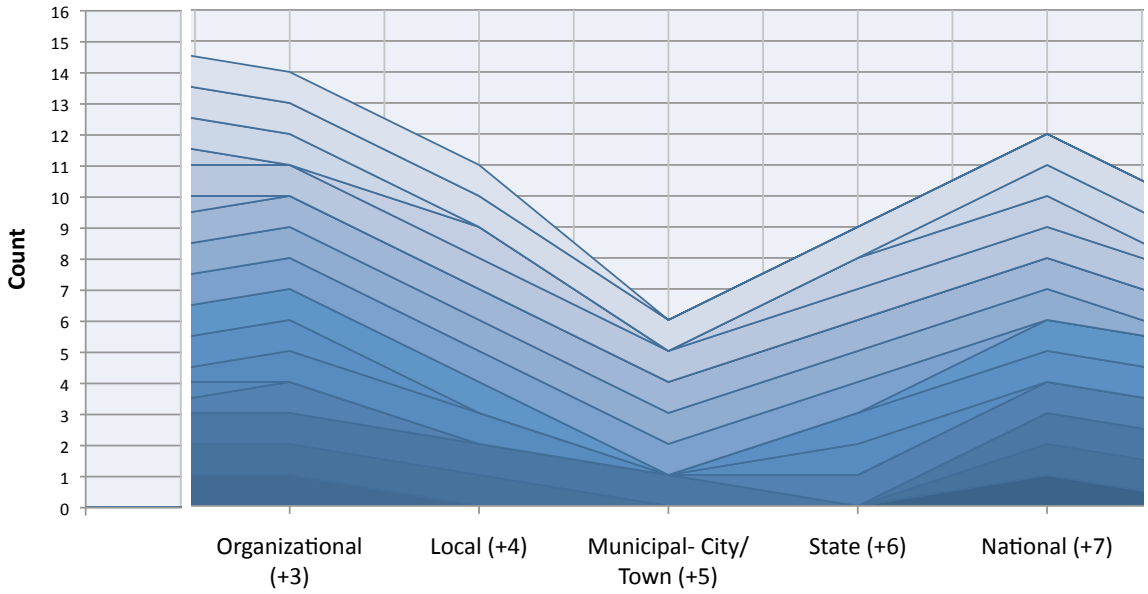
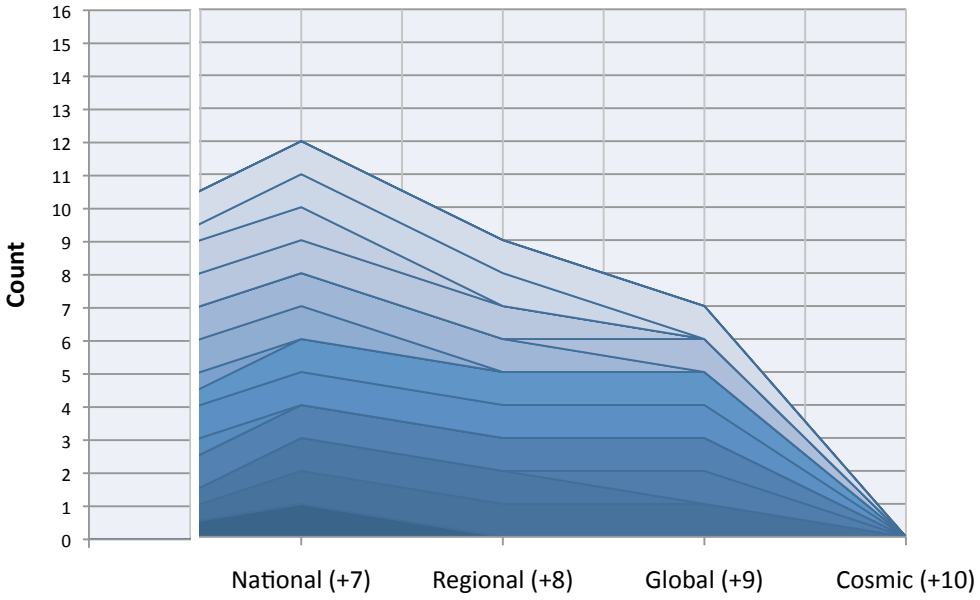
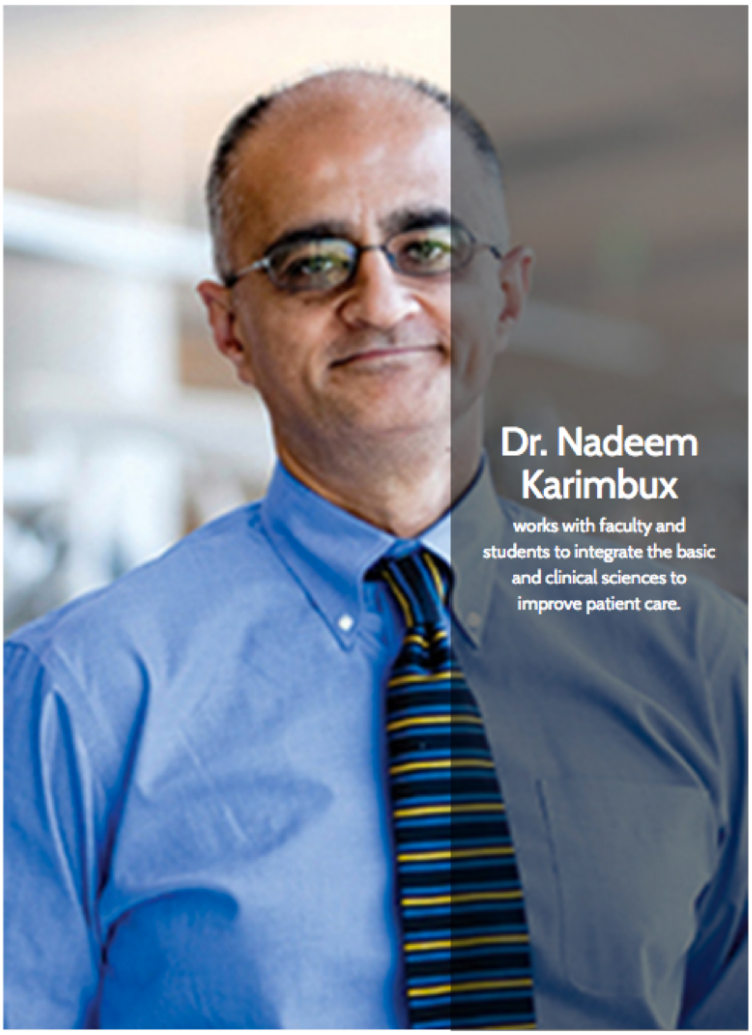


Figure E-35: Outlaw Problem Index Study, Zoom 5



Appendix F – Images of a Completed Professional Pathways Profile

Figure E-36: Portrait, Audio Story, & Professional Affiliations



Problem, Challenge, or Focus:

Helping Dental Students to Treat Their Patients Using a Patient-Centered Comprehensive Care Model

Listen to Nadeem Karimbux's Story

Tufts University | School of Dental Medicine

Profession: Clinician, Educator, Researcher

Job Title: Professor of Periodontology Associate, Dean of Academic Affairs, Editor: Journal of Dental Education

Organization: Tufts University School of Dental Medicine

Possibility Fellow: Jason L. Outlaw

Figure E-37: Interview Transcript

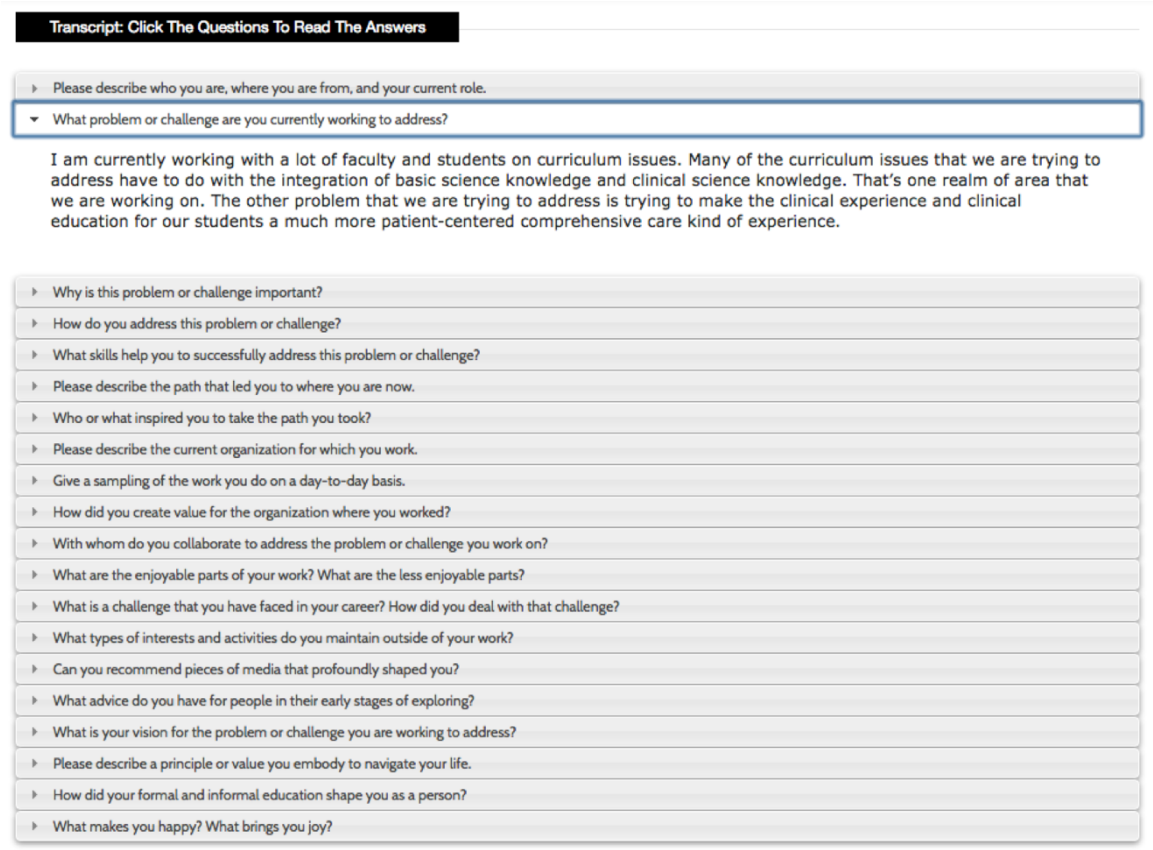
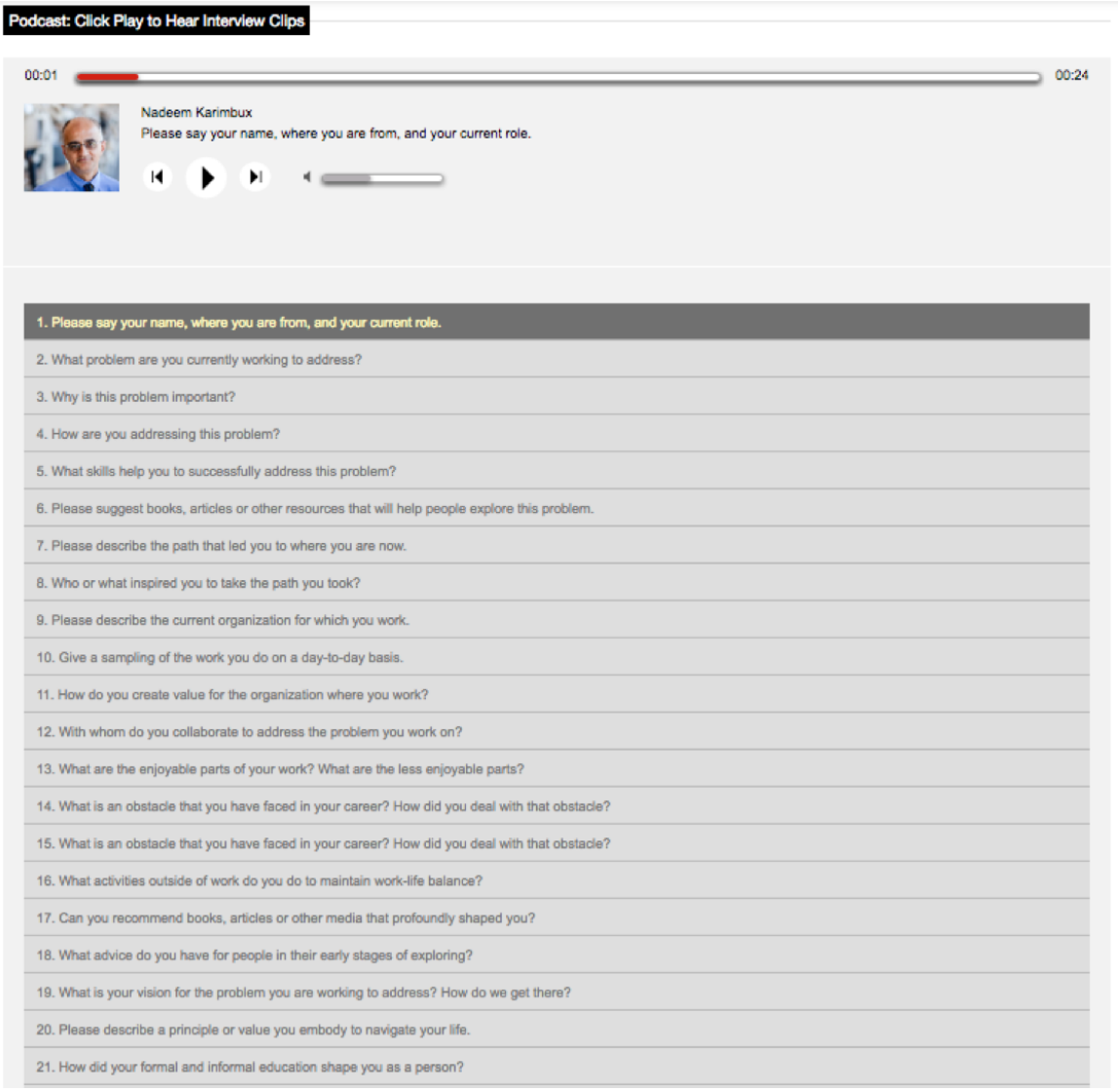


Figure E-38: Possibility Podcast



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