



# **Best Practices in Building Relationships and Partnerships Between Community Colleges, Universities, and Organizations (Work In Progress)**

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## **Abstract**

Understanding how to build relationships between universities, organizations, and community colleges could encourage more inter-organizational work through the formation of intentional and strong positive relationships. In this work in progress paper, we discuss how we fostered a research collaboration between faculty, administrators, and researchers at two community colleges, two universities, and several professional welding organizations. The intent of the overarching research project is to study and improve the educational experiences, outcomes, and career pathways of welding technology (WT) students. During the facilitation of this project, the team has successfully cultivated and leveraged relationships and partnerships to help inform the study. As a result, the Project Team recognizes the importance of capturing how we develop and leverage these relationships to address project needs and produce deliverables. The formation of the relationships between researchers, practitioners, employers and professional organizations is rarely examined and documented in technological education. Thus, this work allows us to capture and share the theoretical and practical knowledge about how we have developed, maintained, and leveraged these partnerships with engaged leadership from our community college principal investigators. In this work, we present: (1) a brief review of literature about team science and (2) best practices related to our process of cultivating and leveraging relationships between the Project team members, faculty and industry employers. This work provides theoretical and practical knowledge about partnership development in Advanced Technological Education (ATE) projects that can provide critical insights about creating and leveraging partnerships between researchers, faculty, and practitioners.

## **Introduction**

Scholars consistently agree that collaboration and formation of teams allows for greater benefits in solving the complex problems of the present day [1]. This is enhanced through multi-organizational collaboration; however, such collaborations also lead to an increase in issues with solving team conflict and hardships in setting up groups for success [1]. The purpose of this work in progress paper is to 1) present an overview of the literature on organizational teams and team science and 2) document the best practices related to our experience cultivating and leveraging relationships with key stakeholders while working on a multi-organizational research project. The multi-organizational research project referenced in this paper is focused on studying and improving the educational experiences, outcomes, and career pathways of welding technology (WT) students. During the facilitation of this project, the team has been successful in engaging advisory board members (i.e., Senior Personnel, welding faculty, and welding industry

employers) across various organizations and professional backgrounds. From this experience and our review of literature on organizational teams and team science, we have captured some best practices related to developing and leveraging relationships across organizations and different professional backgrounds, which are presented in this paper. Our guiding research question for the literature review is as follows: What literature exists about team science (in relation to building cross-contextual team relationships)? Based on the literature and our current project, we discuss some best practices for cultivating and leveraging multi-institutional relationships with team members from various contexts (e.g., university and community college faculty and staff, businesses, non-profit organizations, etc.). First, we provide background information on our multi-institutional project and team science in order to understand the literature that was reviewed. Next, we provide a brief explanation of the methods used to conduct the literature review on team science and cross-organizational team relationships. Then, we summarize the key themes that were found throughout the literature. And finally, we detail our own team observations and findings to suggest potential best practices for successfully developing multi-institutional teams.

## **Background**

### *Background about our Multi-institutional Project*

Our project is a research grant collaboration between faculty, administrators, and researchers at two community colleges and two universities in Southeast Michigan— Macomb Community College, Monroe Community College, Wayne State University, and the University of Michigan—and several professional welding organizations. The intent of this overarching multi-institutional research project is to study and improve the educational experiences, outcomes, and career pathways of welding technology (WT) students. To aid in this process, the Principal Investigator (PI) and Co-PIs have formed connections and relationships with Southeast Michigan welding employers and with members of the American Welding Society (some of whom serve on the advisory board). In particular, the Senior Personnel are engaging in action research by helping to co-create the study protocols and facilitating informational interviews with welding faculty and employers. Likewise, the Principal Investigator (PI) and Co-PIs have formed connections and relationships with Southeast Michigan welding employers and with members of the American Welding Society. Through engaging in several advisory board meetings and conversations, the Project Team has cultivated and leveraged relationships and partnerships to help inform the study project. The formation of relationships between researchers, practitioners, employers and professional organizations is rarely examined and documented in engineering technological education. As a result, the Project Team recognizes the importance of capturing how we develop and leverage these relationships to address project needs and produce deliverables.

## *Team Science*

Team science examines the processes of work that involve more than one individual. The science of team science is a field that aims to understand the development of teams formed for the purpose of solving complex problems for which one person's skill set may not be sufficient [1]. With the growing complexity of problems, it is essential that we examine and explicitly define practices and conditions that result in successful and unsuccessful teams [2]. This body of research observes the different components that may affect the operations and success of teams. In addition, team science can inform the formation of these departments as well as successes or conflicts within them. Team science also spans to cross-organizational formation of connections, which is what we focused on in this work. In this paper, we present a brief literature review of team science literature as it relates to cross-organizational work and best practices related to our process of cultivating and leveraging relationships between the project team members, faculty and industry employers in a multi-institutional project.

## **Methods**

For the literature review, we searched Scopus and EBSCO databases to perform a thorough review on team science literature in the context of cross-organizational work. First, we used the search term "Team Science" OR "Science of Teams" to begin the search, which resulted in 36,984 articles. To focus on relevant articles, we used the following inclusion criteria: 1) Articles needed to be open access and peer-reviewed due to the brevity and summary of information and 2) Subjects were limited to management and engineering. For the exclusion criteria, we did not include any articles from the medical field because the context is not directly relevant to the research project. Next, keywords were limited to "project management", "management sciences", "teamwork", "interpersonal communication", "interprofessional relations", "management", "interdisciplinary communication", and "systems science", resulting in 126 articles. From those search results, we screened the abstracts and selected articles that were focused on cross-disciplinary collaborations. This resulted in a total of eight articles included in the review. All of the articles used from our search contain information on collaboration between multiple organizations as well as the classifications of organizations to provide insights into cross-organizational collaboration. To document our findings and identify potential best practices for successfully developing cross-institutional teams, we compiled the key ideas from our literature search into categories. From this categorization, three main themes emerged as best practices to establish and maintain cross-organizational collaborations. Also, with our IRB approval, we share some insights about our team's best practices based on informal feedback in the Discussion and Implications section.

## **Results: Literature Review**

We identified eight articles that discuss collaboration through combinations of research and companies, departments within institutions, as well as groups composed of members from different backgrounds. The articles included in the review are presented in Table I below.

TABLE I.  
Summary of Team Science and Cross-Organizational Collaboration Articles

<b>Authors (Year)</b>	<b>Journal/Report</b>	<b>Research Methods</b>	<b>Results/ Findings</b>	<b>Setting(s)</b>
Cheruvilil, K.S., Soranno, P.A., Weathers, K.C., (...), Filstrup, C.T., Read, E.K. (2014)	Frontiers in Ecology and the Environment	Qualitative	Interpersonal skills and member diversity are the most important factors for a successful team.	Ecological Research Collaborations
Harris, F., Lyon, F. (2013)	Environmental Science and Policy	Case Studies	When involving various industries and backgrounds, we must leverage existing networks to form relationships. This trust expands sharing within the team.	Environmental Sustainability and Land Use Research
Van den Hout, J.J.J., Davis, O.C., Weggeman, M.C.D.P. (2018)	Journal of Psychology: Interdisciplinary and Applied	Qualitative, Secondary Analysis	By identifying members' skills, challenges, and personal identities we can expand team potential.	Team flow in Workplace
Boger, J., Jackson, P., Mulvenna, M., (...), Grigorovich, A., Martin, S. (2017)	Disability and Rehabilitation: Assistive Technology	Literature Review	Unifying the community with the common goal can encourage sharing of ideas and perspectives.	Assistive Technologies
Manning S. (2017)	Research Policy	Literature review	Core team framework with industry networks and partners unlocks more work that teams can complete.	Project Network Organizations
Stephen M. Fiore (2008)	Small Group Research	Qualitative	Interdependence allows teams to target strengths of members to boost teams.	Team Science; Graduate Education
Cooke N.J., Hilton M.L. (2015)	Enhancing the Effectiveness of Team Science	Qualitative	Diversity is the main factor in successful teams. Also identifies various types of team collaborations and their contributions.	Team Science
Cox T. (2013)	Encyclopedia of Management Theory	Qualitative	Cultural differences and backgrounds among people can enhance and cause conflict within groups.	Team Science

There were underlying patterns that connected each of the eight articles, summing up to 3 main themes. The themes involved the concepts of: *diversity*, *trust*, and *communication*. In the following sections, we present summaries of each of the themes.

### *Theme 1: Diversity Providing Increased Perspectives*

The development of a strong and credible team requires participation of members from diverse backgrounds to widen the perspectives and operations of the team. Three out of the eight articles discuss the importance of teamwork between people with different experiences [3], [4], [6]. Teams with members within the same field, and even with the same years of experience on a project, can often overlook many factors that may be important for a project, such as costs. By incorporating factors like career stages, familiarity with project information, outside viewpoints, and number of people from various disciplines, the perspectives on a problem can widen and shift to allow for the team to work more effectively, efficiently, and creatively [3]. Along with incorporating diversity, it is essential to recognize the strengths, skills, perspectives, and weaknesses of collaborators in order to situate tasks in a manner that allows those with strengths in a particular area to excel in those areas of the projects [4]. Also, if team members know information outside of the realm of their specific tasks, discussions may improve with an increase in a variety of perspectives from different members [4]. This is further supported by authors such as Fiore who suggests that teams consisting of members with varying levels and types of expertise in both technical and teamwork skills collaborate to increase interdisciplinarity and encourage creative problem solving [6]. There are added dimensions to a team's perspective on a project with diversity, but with this comes defining differences in identities that can cause separations between members if not recognized [5].

### *Theme 2: Developing Trust to Support Operations and Creation*

It is important for team members to develop trusting relationships with each other to decrease friction of operations and increase the flow of creation. Five of the eight articles emphasize how in almost all teams it is impossible to reach maximum potential without the team members having confidence in one another's abilities and character [3], [4], [6], [7], [8]. According to Cheruvelil, one of the key factors behind trust is interpersonal skills [3]. By practicing interpersonal skills and increasing awareness of the way employees navigate through their systems, people are able to work together smoothly, decreasing conflict within the workplace, and building an open space for creativity, brainstorming, and unanticipated development [3]. Collaboration and trust is important in order to break down the barriers for open communication between collaborators from varying backgrounds [4], [6]. For example, in the development and collection of research for environmental and sustainability purposes, often research institutions, industries, and members residing in focus areas must work together in order to share ideas and information to improve the environmental causes at hand. As people are often from different educational and professional backgrounds, the relay of information can feel restricted if there is

not a foundation of trust bridging disciplines [7]. This can be done with individual connections of character, processes or through third party networking in order to increase familiarity and comfort between members [7], [8].

### *Theme 3: Formation of Open and Efficient Communication Networks*

Teams across institutions are best built through strong communication networks and open transfer of information regarding personal experience and work. Five out of eight articles stated the importance of communication within projects to build a clear flow and harmony within the team [3], [4], [7], [8], [9]. Open communication networks and established formats are essential, as the miscommunication of information can push back a project as well as decrease the trust between members [4]. Through the formation and agreement on communication pathways and the use of such open networks, team members create a space with minimal judgment or restriction in what information can be shared [4]. With this, people are aware of their responsibilities and can depend on quick relay of information while building interpersonal skills and developing relationships with other team members. By creating open networks for communication to build on interpersonal skills and develop relationships with other team members, teams can create a space with minimal judgment or restriction in the information that can be passed [7]. Through this, teams can establish specific, reliable, and open communication networks in order to organize projects and keep work on track in an efficient manner [3]. The overall structure of a project can also be essential in providing proper communications and frameworks to the operations and flow. In many existing successful operations, teams consist of a core existing team and flexible complementary partners who may come and go [9]. By formatting teams in such a way, projects are able to establish members of the team essential to the whole project and prioritize certain relationships and communication pathways over others. Along with this, due to the diversity of backgrounds and education of members, there are barriers between fields and organizations that we must be conscious of such as the procedures, terminology and perspectives about information that is essential to the work at hand [8]. It is important to be conscious of these diversities and establish consistent frameworks such as a universal vocabulary, and methods in various scenarios and educate one another on information from the various fields [8]. Much of this requires strategic coordination and initial open conversations to set rules and guidelines for smooth collaborations.

Through this review, we have found three key themes that may be essential to the formation of a successful team: *diversity, trust, and communication*. In addition, through our own observations of how we have built relationships among welding organizations and academic institutions to improve the education and outcomes of welding technology students, we have found these best practices to be relevant. There is a lack of information published on cross-organizational collaborations in the mentorship and research space. Many of the articles in existence focus on business interdisciplinary work as well as work focusing on social and environmental issues at hand. Within our ATE project, we have limitations in our type of work in relation to the literature researched. Our team is also smaller in size compared to many of the institutions and groups touched on in some of the journals. This may influence how effective certain practices may be compared to others.

## **Discussion and Implications**

In this work, we found research that suggests that to strengthen work in multidisciplinary teams, there are three main foci that should be developed and practiced as a team for success. Along with technical skills that may be necessary to solve complex problems for which cross-organizational collaboration is necessary, the development of soft skills is essential for team growth [2-3]. Collaboration should be based on a strong framework that is set up in a manner for a clear path for communication, as well as a diverse group in regards to not only skills, levels of expertise, and professional skills, but also team members' personal identities and backgrounds, which may help to increase perspectives on the project at hand [1], [3]. After creating such a foundation, it is essential for members to build trust with one another.

There are two main implications from the results. First, teams should focus on the continuous practice of developing interpersonal skills between team members in various forms [3]. This allows for team members to develop stronger relationships with each other as well as improve their communication networks and share ideas more freely. Second, when forming teams, implementing the proper framework in terms of the organizations involved, type of work, and overall goals [9] is essential to build a basis for clear communication and development of trust. With this framework, we are able to provide the opportunity for diversity in teams as well as an established harmonious environment for unique organizations to come together.

When implementing such practices, the success of teams increases as the basis for a team is not just the technical skills, but also the interpersonal skills of members [3]. We gravitate towards other people who are familiar as well as sociable and welcoming as human instinct. This gravitation is essential for work as it can help form trust between one another. If members are not provided an environment where they are able to easily work together and express themselves, they may feel restricted and in turn hold back essential ideas and resources that would otherwise propel the project forward. Once we can develop personal skills and work together in unison, we can use our technical skills and talents to work together to solve the complex problems at hand.

## **Best Practices Suggestions and Examples**

Teams should give importance to the continuous practice of developing interpersonal skills between team members in various forms. In order to develop trust and communication within teams in the multidisciplinary collaboration space, it is essential for teams to practice interpersonal skill development [3]. By incorporating such practices into regular team operations as well as in the underlying team culture, teams may be able to face challenges and achieve progress more efficiently. When teams across organizations are formed, oftentimes members are not familiar with one another and the culture of work, and backgrounds and skills of all members. By encouraging conversation on such topics, members become increasingly aware of the advantages and abilities of the group and can utilize those to their advantage. It is essential to do so and strengthen both the professional and personal relationships of members in order to foster trust and respect. This can be achieved through face-to-face conversations within and outside of work and these interactions can be fueled by intentional conversations in subjects that



a team may encounter such as diversity boundaries, conflict resolution, and relay of information [8], [3]. By having conversations on such things, the workspace environment becomes more welcoming as members grow more familiar with each other and the project at hand. This also reinforces the team's goals and mission, bringing members together to encourage discussion and ideas which challenge present perspectives [8]. Through the development of trust and interpersonal skills, people are aware of what is expected from them and may execute at the best of their abilities. In our ATE Research team, we have identified that a key factor to our success as a multi-organizational cross-industry team is clear, timely communication. The basis for this is that our team members have trust in one another's skills and have had conversations about the diversity on the team and the skills we can use to our project's advantage. Through the improvement of interpersonal skills and the encouragement of such conversations, we are aware of our responsibilities and common goals, and provide resources and responses in a timely manner. Along with this, information is exchanged in a clear and concise manner that everyone on our team can understand, even though team members are from varying disciplines. This is due to clear and unambiguous vocabulary used in our constructive communication. These are positive traits, as identified in many papers in our review. These findings explain that we have established mutual accountability through our connection to our mission and common goal. By developing personal relationships and skills such as active listening and constructive evaluation, teams can develop a safe space to share ideas, ask questions, and communicate clearly. [4]

When forming teams, implementing the proper framework in terms of the organizations involved, type of work, and overall goal is essential to build a basis for clear communication and development of trust [9]. By doing so, we can develop relationships within the core group and build a strong foundation. When observing many cross-disciplinary successful collaborations and projects, it was found that these teams often followed an organization with a core group of members across industries which would then utilize complementary partners who may work with the core team for varying periods of time as necessary [9]. To develop pools of industry contacts, it is important to have "connectors" on a team who are able to use their networks and established relationships to form partnerships for other collaborations which may be essential for a project [3]. We currently implement this through our core group of researchers from varying industries. Senior Personnel, Principal Investigators (PIs), Co-PIs and other permanent project faculty can be classified as part of this research collaboration's core team. Our members from the University of Michigan have used their contacts to bring aboard graduate and undergraduate students to leverage their knowledge in the project. Macomb and Monroe County Community College's faculty members have engaged their networks of faculty and students in their welding technology programs for many tasks as well, such as conducting interviews and collecting data and personal statements on welding technology development programs and resources.

Though this established framework of a core team with complementary partners is a helpful guide to form teams, we must also keep in mind that all skill sets and projects may be restricted if following this formatting strictly. For this, establishing a framework of our own, not perfectly fit to existing guidelines, allows us to format our communication and operations as fit to the team's needs. We have also identified the skills and resources that members of our team have given their own backgrounds and institutions. This is helpful in that the awareness of such

information and using it to intentionally structure communication and frameworks of teams allows for easy relay of information to personnel who may need it.

Once the initial frameworks and organization of the team have been established, it is critical to identify the goals and objectives of everyone involved and discuss the mission that unites members of the team together. This creates a sense of community and improves the trust and ability to communicate between members. Along with this, due to the diversity of backgrounds and technical skills and knowledge of all members, the use of universal vocabulary and formation of guidelines or protocols in the case of special situations or circumstances. This creates a community culture within this collaboration which may combine the environments from all industries involved.

Based on the literature review and our experiences with the ATE project, we have found some best practices for cultivating and leveraging relationships across team contexts. First is to continuously develop and leverage the interpersonal skills of members and recognize the strengths of one another in order to encourage trust and communication, which can be done through community conversations and face-to-face interactions. Our team has been able to do so and use their interpersonal skills to develop expectations for one another and establish open communication within their frameworks. Second, the development of a framework, (i.e., core team of PIs, Co-PIs and Senior Personnel with non-permanent members such as interviewees) for the team is important to improve the flow of communication and use the diverse skills and perspectives on the team to produce favorable outcomes and deliverables. By using our own networks and contacts, we have leveraged trust and our knowledge of members' skills when forming our team. We also have formed a core team for which the framework encourages open sharing of ideas and the development of trust across diverse organizations. Outside of the literature review, our team has identified that for us to be successful, we have also practiced inclusion and transparency with all members. We have also sent updates to collaborators who were not part of the core project team in order to instill trust, improve relationships, and practice communication. Another practice that we have used is extensive planning and organization within our work and communications. By utilizing pre-planned agendas, we work through project tasks in an efficient and structured format which allows team members to complete their best work.

## **Conclusion**

Within this study, we have conducted a literature review in order to develop an understanding of team science and cross-organizational collaborations. From this and our own multi-institutional project work, we have identified some best practices for successful collaboration in multidisciplinary and cross-organizational work. To establish a successful collaboration, we must not only focus on the skills offered, but also the diversity, communication, and trust within the team. To do so, we recommend establishing a framework that recognizes and is inclusive of all the skills and diversity of team members as well as the practice of interpersonal skill

development to foster trust and more open communication. Outside of this literature review, we have also found that our team has developed the practices of making information accessible for all people involved on the project and facilitating concise plans for meetings to keep our project moving efficiently.

There are several implications of this work for research and practice. We have found that there is a lack of publications and research in cross-organizational collaboration, especially with the involvement of varying academic institutions. Due to this, more research should be conducted about team science for us to gain a better understanding of how to develop successful multi-industry teams that tackle various issues. Within technological education research, the cross-disciplinary functions between many fields and industries calls for efficiency in cross-collaborative performance. In turn, this work will also form perspectives and a pool of skills which are essential to solve such complex problems for which cross-organizational collaboration is necessary. We are continuing in our search and review of literature which covers cross-organizational collaboration involving academic institutions.

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## References

- [1] Cooke Nancy J and Hilton Margaret L, *Enhancing the Effectiveness of Team Science*. National Academies Press, 2015. doi: 10.17226/19007.
- [2] D. Stokols, K. L. Hall, B. K. Taylor, and R. P. Moser, "The Science of Team Science. Overview of the Field and Introduction to the Supplement," *American Journal of Preventive Medicine*, vol. 35, no. 2 SUPPL. Aug. 2008. doi: 10.1016/j.amepre.2008.05.002.
- [3] K. S. Cheruvelil *et al.*, "Creating and maintaining high performance collaborative research teams: the importance of diversity and interpersonal skills," *Front. Ecol. Environ.*, vol. 12, no. 1, pp. 31–38, 2014.
- [4] J. J. J. van den Hout, O. C. Davis, and M. C. D. P. Weggeman, "The Conceptualization of Team Flow," *Journal of Psychology: Interdisciplinary and Applied*, vol. 152, no. 6, pp. 388–423, Aug. 2018, doi: 10.1080/00223980.2018.1449729.
- [5] T. J. Cox, "Interactional Model of Cultural Diversity," in *Encyclopedia of Management Theory*, SAGE Publications, Ltd., 2013. doi: 10.4135/9781452276090.n136.
- [6] S. M. Fiore, "Interdisciplinarity as teamwork: How the science of teams can inform team science," *Small Group Research*, vol. 39, no. 3, pp. 251–277, Jun. 2008, doi: 10.1177/1046496408317797.
- [7] F. Harris and F. Lyon, "Transdisciplinary environmental research: Building trust across professional cultures," *Environmental Science and Policy*, vol. 31, pp. 109–119, Aug. 2013, doi: 10.1016/j.envsci.2013.02.006.
- [8] J. Boger *et al.*, "Principles for fostering the transdisciplinary development of assistive technologies," *Disability and Rehabilitation: Assistive Technology*, vol. 12, no. 5, pp. 480–490, Jul. 2017, doi: 10.3109/17483107.2016.1151953.
- [9] S. Manning, "The rise of project network organizations: Building core teams and flexible partner pools for interorganizational projects," *Research Policy*, vol. 46, no. 8, pp. 1399–1415, Oct. 2017, doi: 10.1016/j.respol.2017.06.005.