ABSTRACT

The effect of collaboration on team success for groups that competed in the 2015 iGEM competition was investigated. Due to the necessity of quantifying and identifying valid parameters to measure “success”, data on the achievement of medals and special awards were used. Firstly, the network analysis was conducted by classifying the teams into their respective geographical location. These teams were referred to as “donor” teams. Classification of teams was based on the null hypothesis test which proved that each geographical region, with a statistically significant sample size, had a clear variation with the average medals won between population clusters. Next, based on geographical classification, a null hypothesis test was conducted to test the effect of team size on the type of awards won. The existence of a possible optimal team size was investigated by filtering the teams with gold, silver, or bronze medal achievements. An average of the team size of the respective categories were then calculated. Interestingly, in Latin America, the team size did not affect the medal value of the participants. A review of literature which includes the social theories of homophily and heterophily, social capital, and social loafing helps create a basis for understanding the findings from the null hypothesis testings. These connections can be analyzed in further detail for the formulation of recommendations to iGEM.

INTRODUCTION

The International Genetically Engineered Machine (iGEM) competition is a global synthetic biology initiative for high school, undergraduate, and graduate students to conduct research and solve real-world problems using synthetic biology [http://igem.org/Main_Page]. Creating a cooperative environment for the purposes of educational and synthetic biology related advancements is one of the key values the iGEM Foundation subscribes to [http://igem.org/Values]. True to its values, the organization mandates teams to collaborate in projects with other teams when striving for a silver medal qualification [http://2016.igem.org/Judging/Medals].

The Waterloo iGEM chapter analyzed data from the 2015 iGEM competition to determine the value of collaborations in relation to accomplishments in the iGEM Jamboree. The results from the hypothesis testings were further applied in context to the relevant social theories discussed in this paper.

1. Null Hypothesis: When looking at the total sample size of each statistically significant group classified based on geographical location, the outcome from the number of teams that collaborated out of the total sample size DO NOT show a bias towards collaboration.

Test performed: Cumulative and Exact binomial test were performed using a confidence interval of 99%.

Objective: Despite having the knowledge of collaboration being encouraged by iGEM as an organization, this test was done to quantitatively verify the assumption. The findings from this test adhered to the expectations of teams being biased to collaborate in order to qualify for the silver medal criteria.

2a. Null Hypothesis: For any statistically significant sample size from each geographical region, if team size is an independent variable and the total award is the dependent variable, then the independent variable has no effect on the responding. Total award was defined with the value of medal won based on the type of medal and any special award.

2b. Null Hypothesis: For a statistically significant sample size from each geographical region, if team size is an independent variable and the type of medal won is the dependent variable, then the independent variable has no effect on the responding.

Test performed: Linear regression analysis using a 99% confidence interval

Objective: Whether the team size has any impact on the type of medal the teams won was tested here in order to assist in the verification of the assumption: if all else equals, the structure of how an iGEM team is constructed (with attributes such as team size) can affect the success level of the team. Success is grossly simplified for this test for quantification purposes by using level of medal wins and the existence of a special award win as success factors.

The degree to which the independent variable of team size affects the responding variable of success was accounted for using the adjusted R-squared value. The result of this hypothesis test led to further investigation on issues such as social loafing that can be seen in team environments. It is not within the scope of this paper to predict the optimal team size each iGEM team should have. However, filtering the results for all the teams around the world that participated in iGEM for 2015 and won any sort of medal or special award, the average team size was approximately 13. We noticed in the "Requirements" section on the 2016.igem.org site under *1.4 Recommendations* that the recommended number of students in an iGEM team is 8-15, and that team size does not affect team score (http://2016.igem.org/Requirements). Our findings differ in that we looked at optimal team size for teams that also had collaborations. This opens the platform for further research for an optimal team size iGEM teams should strive towards when forming teams to eliminate social loafing, or under-recruitings and be strained for resources.

3. Null HYPOTHESIS: It was hypothesized that as the factor of collaboration is held constant for each statistically significant sample size from each region, there is no difference between the mean medal value that is won in each population. Meaning, if a random sample of teams from North America, Latin America, Europe, and Asia are selected where the mean value for each team's medal win is u1, u2, u3, u4 respectively, then u1 = u2 = u3 = u4.

Test performed: Single factor Anova Test using a 99% confidence interval.

Objective: Since teams were classified using their geographical location for Null Hypothesis 1 and Null Hypothesis 2, this test was done to prove that there was indeed variation between the clusters in order to justify the first two hypotheses which is focusing on differences among teams within each cluster.

LITERATURE REVIEW

Social networks and Limitations of ERGMs

A social network describes a structure of relationships between actors, who may be individuals or organizations, in the form of dyadic relational ties (Robins, 2015). According to Robins, these dyadic ties may furthermore be multiplex, meaning that there is more than one relational tie between the two actors. Important to recognize is the idea that with regards to network science, outcomes of a social network are not created by actors but by the relationships *between* actors. In this way, actors of a social network are dependent on each other, and by extension, their relationships with each other are also dependent on each other. Also important to recognize is the idea that within social networks, actors have *intentionality*. Actors in the network are not passive receivers of network outcomes, but active creators of network outcomes. Social networks can be modelled with graphs, where nodes in the graph represent actors, and edges in the graph represent the relational ties between them, existent or non-existent.

Exponential Random Graph Models (or ERGMs) are models of network structure, meaning they predict the odds of tie formation. Since the formation of nodes within collaboration are purposely created, ERGMs have no use within this research paper (Hunter, 2008). In addition, by analyzing the precursor to ERGMs, one can see the further lack of compatibility between this model and the network analyzed in this paper. ERGMs are inspired by Erdős–Rényi random graphs and follow two assumptions: the nodes connect at random and they move in an undirected network (Zanghi, 2008). When collaborating, nodes do not connect at random due to the purpose and intentions of collaborations. Also, iGEM collaborations have directionality. As a result, ERGMs cannot be the model of choice in this scenario.

Homophily

Homophily describes how similar people tend to socialize more with each other than with dissimilar people (McPherson, 2001). Similarity can be determined by a variety of sociodemographic, behavioural, and intrapersonal characteristics (such as ethnicity, age, and education). Factors such as geographical and organizational membership are some of the notable causes of homophily between individuals (McPherson, 2001).

McPherson goes on further to say that status homophily is based on sociodemographic dimensions and acquired characteristics of an individual. Value homophily is based on an individual’s values, attitudes, and beliefs. Homophily can be a main cause of mutual benefit or mutual destruction. This is because people with similar characteristics or ideals flock together within geographical or organizational divides. Thus, a greater amount of efficiency happens through shared context, or destruction happens through maladaptive groupthink.

Conversely, Heterophily describes dissimilar people socializing together (Rogers, 1970). People with different innate and acquired characteristics seek each other out to gain benefits that cannot be found within more similar groups of people. Information localization and spreading can be explained by homophily and heterophily where homophily is the mechanism that forms close-knit groups, while heterophily connects close-knit groups within the social network (Liu, 2015).

Homophily can be contributive to established structural holes, and by extension the social network, when in conjunction with heterophily. In the article published by Liu and Duff, it is elucidated that while homophilic relations are the key force behind the accumulation of information, heterophilic relations are essential for the diffusion of information. In other words, the accumulation of information provided by homophily can be advantageous for a wider social network if that information is propagated to other close-knit communities by heterophilic mechanisms.

Social Capital

Social capital is the willingness of people to help each other over expending resources to acquire that same service (Coleman, 1988). Abundant social capital mediates efficient, functional networks where there is facilitation and coordination of mutual benefit between all parties involved. An interactive relationship is required to establish such functionality and efficiency within these networks (Hall, 2004).

One key qualitative measurement of social capital is trust (Johanson, 2001). Teams that trust each other are more likely to help each other (Coleman 1990). Trust can also be described as a catalyst for helping information move within a network more efficiently. The reciprocity of trust between the adjacent nodes can help reduce transaction costs. The need for legal and formal documentation between teams can be bypassed and create a more cohesive social network. Other transactions of social capital can include cooperation and reciprocity which produce goods and services for other networks (Coleman, 1988). Such mutualistic benefit result in establishing the common good between all networks or stakeholders affected.

Structural Holes

As homophily dictates, behaviors are largely homogeneous within strongly integrated groups, and less so between less integrated others. Depending on where one is situated within a social network, particularly one that contains several highly connected clusters, one can poise certain positional potentials (Burt, 2004).

Differences between groups are partly attributed to structural holes in social networks. These cavities exist between two groups or individuals within a network that have mutualistically beneficial knowledge. Individuals or groups (actors) situated in close proximity to a structural hole maintain a clear vantage point (Coleman, 1988). The vantage point is due to those being in closed proximity having the ability to play the role of a mediator. Mediating between groups and bridging structural holes exposes these individuals/groups or brokers to unique ways of thinking, various rationalities, and novel thought processes (Burt, 2004). Filling gaps of knowledge drives creativity and awards an increased potential for innovation and synthesis which is a clear advantage for networks within the structure. Nonetheless, the added responsibility of maintaining connections can prove to be a difficult, time consuming task.

Enabling the diffusion of knowledge within an entire network may allow for all teams to think the same way. Similar ways of thinking can have negative factors attributed to it when a network is trying to generate novel ideas. With many people having access to the same ideas, this can result in maladaptive groupthink, particularly in social loafing. These concepts will be further explored down in the discussion below.

Burt’s Constraint

While betweenness centrality focuses on how many nodes pass through the central node of interest, Burt’s Constraint focuses on the weight given between two nodes that calculates how strong the mutual relation is. Burt's constraint is higher if the vantage point between two nodes are stronger, mutually related, and redundant contacts. Network constraint measures the degree to which a network is directly or indirectly concentrated on a specific node on that network. Burt's constraint value helps understand the size, density, and hierarchy (Burt, 2002).

Size: In large networks, the constraint score is usually expected to be lower. This is because the proportion of one's energy invested in one specific contact is expected to be lower if there are many contacts to invest energy in versus smaller size networks where choices are limited (Burt, 2002).

Density: This factor of the constraint measure focuses on the average strength of connection between nodes in a network. In binary network data, similar to what has been used in this paper related to collaboration, where the focus was on whether people connected or not, the strength of any two networks connecting to each other is proportional to the contact pairs that are connected (Burt, 2002).

Hierarchy: This is another measure within the constraint analysis that analyzes the network closure and the positioning of nodes (Burt, 2002). This measure focuses on whether other network clusters are formed around a specific network. This same analysis can be used within a network cluster to analyse whether a specific node has hierarchical power with other nodes concentrated around it.

Betweenness Centrality

Betweenness Centrality is an indicator that helps interpret the centrality of a node within the respected network (Freeman, 1977). Statistically, betweenness centrality is the shortest number of pathways from other vertices to all others that pass through that team node. The variables needed to express betweenness centrality include the total number of shortest paths from the node, the node itself, and the number of those paths that pass through (Brandes, 2001). This concept can help identify the teams with the greatest influence involved in a network.

By identifying the main nodes of influence, this information can help describe many other social theories including structural holes and how social capital is utilized to transfer information within the designated network.

Social Loafing

Intuition might dictate that work done in groups produce a far greater outcome than the same work completed by an individual when all else equals. Ideally, with the increase of the reservoir of individual skills, resources and talents, the product should also increase in quality. However, social loafing challenges this ideal.

Max Ringlemann first introduced the theory of social loafing in 1913 (Kravitz, 1986). He conveyed that an individual is more likely to exert less effort on a particular task when working in a group as opposed to working alone (Kravitz, 1986). Ringlemann observed that when a group of participants are asked pull a piece of rope, their effort declined significantly when they worked in a team, as opposed to when they worked alone.

Optimizing a network is key to maintaining team efficiency (Ingham, 1974). An optimized network consistent of efficient team is expected to result in a higher success level for any given team. In order to explore the effect of team composition, team size and its effect on the special awards and the type of medal teams won at the 2015 Jamboree was analyzed. A null hypothesis testing was conducted for this purpose.

MATERIALS AND METHODS

Data collection

Data was mined from the 2015 iGEM website. The reader is encouraged to refer to our codebook for specifics on how it was collected.

Jamboree Success

To understand the effect of collaboration in relation to the flow of ideas within each geographical region, all the teams were first categorized in classes based on their continent. Geographical classification was done based on the assumption that the geographic positioning will be a clear factor affecting how the teams interact. The limitation of the data set was that it was only data from 2015. Any continuous trends or analysis based on time was limited because of this.

Quantification of Data

The data that was mined from the iGEM website include qualitative factors such as what type of medal any particular team won, special awards won, and evidence of collaboration (based on parameters set by the data miners). This qualitative data was converted into quantitative data by assigning numerical values to relevant attributes. As outlined in the table below, each medal win was assigned a particular success value. For example, Gold received a value of 1, Silver medal was valued at 0.5, bronze was valued at 0.25, and in the absence of a medal in between received a score of 0. Other attributes relating to any particular team's involvement such as winning or not winning a special award was given a value of 1 or 0 respectively. Teams that did not win special awards received a value of 0. These parameters were further used to help calculate the total awards won by any given team. If a team won a gold medal and a special award, the team was given a total award score of 2. The purpose of setting the scoring in this manner allowed for efficiency to interpret total award results. Looking at any team and its total award value, one can determine what type of award the team must have received. If a team had a total award value of 1.50, it meant the team won some sort of a special award and a silver medal. The only discrepancy was if a team had a total award of 1. This may mean the team won a special award and no gold medal or the team won a gold medal but no special award.

Attributes	Quantitative Value*
Gold	1.0
Silver	0.5

Bronze	0.25
Collaboration - (y/n)	1/0
Special Award - (y/n)	1/0

*these parameters were assigned arbitrarily, parameters can be changed to penalize and reward points differently for the purposes of analysis.

RESULTS

To test the prediction of the different geographical area contributing to the medal value of the team clusters (that has collaborated), a hypothesis test was performed. A single-factor Anova test was conducted to see medal variation within and between groups. A random sample of 47 teams that had collaborated from North America, Latin America, Europe, and Asia was used for this test. The null-hypothesis that was being tested for this was if we hold the factor of collaboration constant, then the mean of the medal won from region to region should stay constant. The test showed that the F value > F critical, which resulted in the rejection of the null hypothesis. Therefore, when the factor of collaboration is held a constant, from region to region, there was a statistically significant difference between the mean medal value won in each population. Please refer to Appendix E for more information.

The next test that was conducted was a linear regression. This test was used to test the following null hypothesis: If team size is an independent variable and the medal win is the dependent variable, then the independent variable has no effect on the responding. A p-value of 0.99 was used as well for this test. The null hypothesis was also extended to total award value where the total award value (medal + special award) was the dependent value.

Region	(x)	(y)	Null Hypothesis
North America	Team Size	Medal	Accept
		Medal + Special award	Accept
Latin America	Team Size	Medal	Reject
		Medal + Special award	Reject
Europe	Team Size	Medal	Accept
		Medal + Special award	Accept
Asia	Team Size	Medal	Accept
		Medal + Special award	Accept
Africa*	Team Size	Medal	-
		Medal + Special award	-
Global**	Team Size	Medal	Reject

		Medal + Special award	Reject

*Africa had a sample size of 3 teams which was deemed statistically insignificant for the performance of a linear regression.

** Data from Africa was still included in the global analysis.

To further analyze to the extent to which the independent variable explain the dependent variable, an adjusted R-squared value was used. In our case after adjusting the R-squared value we get 0.028. This means that the independent variable of team size explains only 2.81% of the variation of our total award (medal + special award) for the global data. For the R-squared value when the dependent variable is just the medal value, we get 0.0167. This means that the independent variable of team size explains only 1.67% of the variation of our medal winnings global data. To see the variability in the R-squared value for the global data from total award to just medal value, please refer to Appendix A. The difference in trends for the Latin America data is also further explored in the discussion section. Please refer to Appendix B for the linear regression analysis specific to Latin America.

An analysis using Burt's Constraint was performed using the constraint function in R programming language with the iGEM 2015 global data. The results of the constraint score was next extracted as node attributes and entered into data frame. The iGEM 2015 teams created the iGEM networks where the network variables were constraints and betweenness. The network was then run in R with the following script to generate betweenness scores:

```
V(iGEM)$constraint <- constraint(iGEM)
V(iGEM)$betweenness <- igraph::betweenness(iGEM)
results <- cbind(V(iGEM)$name, V(iGEM)$constraint, V(iGEM)$betweenness)
```

The betweenness score that was generated was plotted (refer to Appendix F).

DISCUSSION

1. Null Hypothesis: When looking at the total sample size of each statistically significant group classified based on geographical location, the outcome from the number of teams that collaborated out of the total sample size DO NOT show a bias towards collaboration.

Objective: Despite having the knowledge of collaboration being encouraged by iGEM as an organization, this test was done to quantitatively verify the assumption. The findings from this test adhered to the expectations of teams being biased to collaborate in order to qualify for the silver medal criteria.

2a. Null Hypothesis: For any statistically significant sample size from each geographical region, if team size is an independent variable and the total award is the dependent variable, then the independent variable has no effect on the responding. Total award was defined with the value of medal won based on the type of medal and any special award.

2b. Null Hypothesis: For a statistically significant sample size from each geographical region, if team size is an independent variable and the type of medal won is the dependent variable, then the independent variable has no effect on the responding.

3. Null Hypothesis: It was hypothesized that as the factor of collaboration is held constant for each statistically significant sample size from each region, there is no difference between the mean medal value that is won in each population. Meaning, if a random sample of teams from North America, Latin America, Europe, and Asia are selected where the mean value for each team’s medal win is u1, u2, u3, u4 respectively, then u1 = u2 = u3 = u4.

Latin America: A Case Study

The findings from the results of the first null hypothesis test outline the effect of team size in relation to medal wins and special awards. Using a 99% confidence interval, Latin America was the only network cluster from the iGEM network data where the null hypothesis test was failed to be rejected. This means, team size of the Latin American teams had no statistically significant effect on the total awards won. Using the social theories discussed in the literature review, possible suggestions were created to interpret based on the results.

There are both benefits and detriments to structural holes being present within a network. As described in the literature review, social capital is the willingness to help people as a form of currency based on the trust between each node in a network structure. Structural holes are interpreted as a cavity between two nodes of mutually beneficial knowledge. This knowledge is the commodity that is shared via social capital. For example, when there is a clog in information being shared between two teams, an underperforming intermediary node forms between the parties. For example, if mutually beneficial information is given to further teams within their own respective communities, a structural hole forms. This exact circumstance was observed within the Latin American iGEM network structure. When researching structural holes, both positive and negative impacts may have occurred. These impacts would be dependent upon whether the structural hole was present and then preventing or bridging this hole. This would impact the flow of information for all teams in the Latin American network cluster.

As discussed in the introduction of this paper, negative factors attributed to bridging structural hole was briefly explored. An additional benefit, of having the gap of information exist in a structural hole is to decrease a network cluster's susceptibility to social loafing. On the contrary, bridging structural holes can also produce a benefit to the network cluster. By bringing the information together that was once constrained to only a few designated parties, this information is now more accessible. A greater medal value may result in all teams within a network cluster to have mutually beneficial information required for success.

Bridging of a structural hole can be inhibited by homophily. Homophily can be detrimental to the social network because homophily can lead to groupthink. As discussed earlier, the presence of groupthink can stop the generation of novel ideas in a network cluster. Rogers and Bhowmik's 1970 paper on homophily-heterophily in communication asserts that homophilic interactions are the most effective means of communication (Rogers, 1970). Several shared innate and/or acquired characteristics between similar people result in more efficient communication. This is because there is less effort required to understand each other, It could be inferred that the homophily results in a lot of localized, similar information accumulated by close-knit communities within Latin America. These communities were expected to be grouped together based on geography because a single-factor Anova test outlining a clear variation between and within geographically differentiated network clusters (within the iGEM network). Groupthink could be a possible result of sharing similar information and harbouring similar beliefs between Latin American teams.

Team size

As the results section has stated, team size plays a role in the success of an iGEM team. As one may expect, the larger the team is, the more likely they are to succeed. However, as discussed above, social loafing plays a large part in the development of a team or party. When analyzing the results, it was discovered that the global average team size at every medal level was approximately 13 team members. Having an average of 13 team members also correlates to winning a gold, silver or bronze medal and this specific team size average may not be a mere coincidence. One can further explore the correlation of average team size to the concept of social loafing in future studies. Something notable that can be explored is to analyze whether any teams larger than 13 (to a degree of variance) may become susceptible to social loafing by adding extra team members. The number 13 for the average team size is not expected to be a constant over the years.

Constraint Analysis

An analysis using Burt’s constraint was also employed to analyze the 2015 global iGEM team data. Betweenness scores were also generated for each team. The betweenness score was measuring brokerage opportunities. This analysis is closely tied to the analysis of structural hole and social capital which was conducted previously using different statistical testing methods. The betweenness score that was generated (as explained in the results section) was used to verify the assumption that teams with lower network constraint scores should be in positions that are more conductive to brokerage. Teams conductive to brokerage are better able to activate social capital, see what a broad range of neighbouring teams are doing, and how they are working. The social capital of brokerage is that those with a vantage point within a social network can bridge structural holes (Burt, 2002). The graphical representation of this verified assumption through the brokerage analysis is presented in Appendix F. Upon further investigation of the three outliers labeled A, B, and C nodes in the network establish this verification further. Cambridge-JIC is the first outlier showing a low constraint value and a high brokerage. This is expected to be an optimal positioning for the team since they are able to create more connections in this brokerage and receive information flow differently than others in the team. positioning of this team within the iGEM network must have been an influential factor contributing to the team's success since this team had a higher medal value than both Team B and C. Team B , London Biohackspace, was the next team analysed. This team is at a medium constraint value but still at a relatively high brokerage value. London Biohackspace is not positioned in the network as well as Team A with the higher constraint value. Team C, TU Dresden has a high constraint and high brokerage value. TU Dresden won a bronze medal and no special award. All three outliers are teams from Europe. A possible explanation of the higher brokerage value can be related to the three outlier teams all from the European network cluster. The European network maybe prone to connections with a higher brokerage than other network clusters due to having a larger network.

Disclaimer

This data used contained a few data constraints, many missing variables unaccounted for and only one year's worth of data from 2015. The only data collected included the team name, continent the team was from, country the team was from, recipient collaborator team name, medal colour (if a medal was won), whether a special award was won, and if so, what that special award was. Due to the limited amount of data obtained, the Waterloo iGEM team disclaims that this data and interpretations extrapolated by this data are by no means fully justified or correct. By creating this paper, the Waterloo iGEM team hopes that other iGEM teams in future years to come continue to build on this data, provide more variables to the data, gather data from previous years, and use other methods to analyze the data. The purpose of this paper is to set a foundation to be built on in the years to come to gain a full understanding of how collaborations impact an iGEM team's success.

CONCLUSION

Many social theories play a part in understanding the role that collaboration and networking play within the iGEM community. Homophily is the tendency for groups with similar interests to assimilate together. Heterophily is the tendency for groups with different attributes to assimilate together. Social capital is a means of currency where a network or community work together and help each other based off of a foundation of relationships built. Social loafing is the phenomenon where a larger amount of group members put forth less effort than when they work alone or in smaller groups. Finally, structural holes are barriers or cavities between a particular network where mutually beneficial information exists between nodes. This information may be bridged and shared within a network or blocked within these nodes. All of these social theories have a substantial role to play in the understanding of collaborations within all networks built between iGEM teams around the world. This paper has given information on how collaborations affect an iGEM teams' ability to win a medal or special award as well as what variables come into play and how the results may deviate. The social theories mentioned offer a recommendation on how a particular networks deviation from the main trend is based on the shape of the network.

1. Null Hypothesis: When looking at the total sample size of each statistically significant group classified based on geographical location, the outcome from the number of teams that collaborated out of the total sample size DO NOT show a bias towards collaboration.

2a. Null Hypothesis: For any statistically significant sample size from each geographical region, if team size is an independent variable and the total award is the dependent variable, then the independent variable has no effect on the responding. Total award was defined with the value of medal won based on the type of medal and any special award.

2b. Null Hypothesis: For a statistically significant sample size from each geographical region, if team size is an independent variable and the type of medal won is the dependent variable, then the independent variable has no effect on the responding.

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Future Works

Proceeding with what has been discussed in this paper, one can use some promising tools such as ALAAMs for future network analysis. ALAAM stands for Autologistic Actor Attribute Model which can be used to analyse team competition success level (not limited to organizational structures such as iGEM). One recommendation for the iGEM organization is to make it mandatory for all participating teams to upload information on its database in a specific method. This specific data upload on team wikis need to follow a specific format making it easier for data miners to build scrapers using programming languages such as Python. This paper has formed a basis for understanding key network theories and then connecting this network analysis to crucial social theories. These social theories attempt to bridge structural holes which in turn increases social capital. Bridging structural holes in iGEM network can lead to increase in team success. The iGEM community holds success and education of its members at a high priority. The authors of this paper also subscribe to such values and want to encourage the engagement of further research by future iGEM Policy and Practices team to enhance this community's educational goals.