# Challenges and Benefits of Programming Competitions as Outreach to High School Students

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## Abstract

Software development-oriented competitions are one way that computing degree programs like software engineering, support outreach to local high schools. Such competitions motivate students to succeed, help students build teamwork, and assist in improving student software skills. Indeed, there are a variety of different types of competitions ranging from robotics [1] to process-oriented that emphasize team interactions [2]. This paper reports on the approach used by Robert Morris University (RMU) that annually conducts programming competition for area high school students.

The goal of the paper is to provide insight into both how competitions are organized as well as the challenges to and benefits of competitions. In addition this paper emphasizes on how software engineering practices like flowcharts, pair programming, and reviews can be introduced to high school students. The paper will address questions such as: What is the RMU-ACM annual programming competition? How does host institution organize and deliver such a competition? What is the motivation for organizing the competition? What are the benefits for this competition to stakeholders? What are the challenges and how are they handled? What skills do students actually gain in a programming competition? Do programming competitions motivate students to succeed? Do high school students learn software engineering practices? Results of a survey of high school teachers on their perceptions of student motivation and learning as well as the impact of the competition on student career plans are also presented.


## 1. Introduction

Teachers want their students to succeed in what they are taught and seek testing instruments to assess their learning. Sometimes regular testing instruments are not adequate. For such reasons teachers have students participate in academic competitions. Competitions expose and enhance student's practical understanding of the subject matter by providing a platform to practice. Competitions help students become successful, build teamwork, and assist in improving student skills. The experience of going through a design, build, and test cycle under a strict time schedule with well-defined design goals give students more of a "real world" engineering experience than what they get through their standard coursework [3]. Moreover, nearly every interesting and worthwhile venture in life comes with some element of pressure; competition teaches students how to handle it [4]. Competitions make students realize what their strengths and weaknesses are and what areas they have to work on [5]. Besides student competitions also benefit other stakeholders like high school teachers and organizing institutions.

Indeed, there are a variety of competitions ranging from robotics [1] to process-oriented that emphasize team interactions [2]. Benefits to multiple stakeholders motivate institutions to organize competitions suitable to their program goals and interests. For example, Southern Polytechnic State University regularly conducts a Game Jam [6], Western New England University last March successfully organized its Twenty-Eighth Annual Invitational High School Computer Programming Contest [7], and Purdue University conducts a competition on Rube Goldberg machines [8]. The focus of this paper is on a competition involving programming skills and the use of software engineering practices.

Since 2008 RMU has been conducting a programming competition for area high school students. This paper looks into the approaches taken by RMU to organize such an event and discusses the actual skills the students are believed to have gained. Through this paper the author discusses the following questions: What is the RMU-ACM annual programming competition? How does host institution organize and deliver such a competition? What is the motivation for organizing the competition? What are the benefits for this competition to stakeholders? What are the challenges and how are they handled? What skills do students actually gain in a programming competition? Do programming competitions motivate students to succeed? Do high school students learn software engineering practices?

## 2. Institutional Profile

Robert Morris University (RMU), located in Southwestern Pennsylvania, offers a Bachelors of Science degree in engineering (Software Engineering concentration), and has been accredited since 2002. At RMU the emphasis is on small class sizes (10:1 student to faculty ratio) and hands-on experiences through class assignments, course projects, internships (150 hours mandatory), and an interdisciplinary capstone project (3 credits). Graduates at RMU receive two types of transcripts: academic and engagement. The academic transcript depicts student degree progress and grades obtained. The engagement transcript records, by description and hours, student activities outside of the classroom. The institution believes that students must be able to balance academic and extra-circular activities. Software engineering students are members of the Association of Computing Machinery Chapter at RMU (RMU-ACM) of which the author is the faculty sponsor. The annual high school programming competition is one of the annual activities organized by RMU-ACM members. RMU students can earn engagement credits by participating in RMU-ACM activities.

## 3. High School Programming Competition at RMU

### 3.1. The Event in a Nut Shell

For a successful event a number of activities need to be completed. For this event the key competition activities are described below.

- ***Invitations:*** Email invitations “call for participation” is sent out to a number of institutions covering four Southwestern Pennsylvania counties (Washington, Beaver, Butler, and

Westmoreland). In addition some high schools come to know of this event through RMU web pages. The email invitation is a package consisting of registration forms, explanation of the competition with sample questions, submission judging procedure, and directions to the venue. Schools can submit multiple teams with each team having a maximum of three members. In the last five years average student participation in this competition has been 45 (15 teams). Due to space constraints RMU-ACM has limited the maximum number of teams to 17.

- ***Event Agenda:*** The event registration starts at 8:30 am with breakfast and the competition starts at 9:00 am. Before the event starts Dean of the School of Engineering, Mathematics and Science (SEMS), and/or engineering department head welcome the participants. The faculty sponsor then talks about the importance of software and software engineering practices in a societal context. At this time good design, adequate reviews, testing, teamwork, and communication are emphasized. After the speeches the accompanying teachers are separated from their students. While the students are busy in the 3 hour competition, high school teachers have their own program. At 12:00 noon the competition ends and the teachers are reunited with their students. In the meantime volunteers are busy judging the submissions, printing the certificates (for winners and participants), drawing raffles, distributing freebies, and serving lunch. At 12:45 pm the results are announced and the awards presented. By 1:00 pm students head back to their schools.

- ***Competition Problems:*** For the competition a pool of 20 problems are developed by RMU-ACM members. These problems range from easy to hard. On the eve of the event 10 problems are shortlisted. Besides complexity, total completion time is also taken into consideration when selecting the problems. Two sample problems are depicted in table 1:

- ***Submission Requirements:*** For each problem students are required to create a flowchart, use pair programming to code, and adequately review and test their solution. Students can submit their solution whenever they are ready in whatever problem order they choose. Within the given timeframe students can resubmit the solution multiple times; however for each incorrect submission points are deducted. A correct flowchart is awarded 15 points and code submitted correctly the first time is awarded 100 points. Maximum points achievable are 1150 (150 for flowcharts and 1000 for codes).

- ***Judging Software:*** The judging software used for the competition is $PC^2$ [9]. $PC^2$ is the Programming Contest Control System developed at California State University, Sacramento (CSUS) in support of Computer Programming Contest activities of the ACM, and in particular the ACM International Collegiate Programming Contest (ICPC) and its Regional Contests around the world. $PC^2$ (pronounced "P-C-squared" or sometimes just "P-C-Two" for short) is a software system designed to support programming contest operations in a variety of computing environments. PC$^2$ allows contestants (teams) to submit programs over a network to contest judges. The judges can recompile the submitted program, execute it, view the source code and/or execution results, and send a response back to the team. The system also supports an "automated judging" mode where judging is performed by software rather than by human judges. [9] As the students submit their code PC$^2$ keeps track of the time. In addition to the time, every time a code is sent back with an error the program deducts points.

**Table 1: Sample problems**

**Sample Problem 1:** Secret Savings

Auditors recently discovered some old documents that belonged to Robert Morris, financier of the American Revolution. It seems that he held several savings accounts that went unnoticed for a good number of years. Given the information from these documents, determine the value of his savings over time.

Input is in the form of: Principal amount, Annual nominal interest rate (as a percent), Number of times the interest is compounded per year, Number of years

Output is in the form of: Value after time

All output should be rounded to the nearest cent. No input will contain fractions of a cent. Number of years will always be whole years.

Sample Data:

| Input | Output |
|---|---|
| 1500, 4.3, 4, 6; | 1938.84 |
| 2000.25, 2.9, 2, 10; | 2667.63 |
| 10000, 8, 1, 5; | 14693.28 |
| 1234.56, 7.8, 9, 120; | 13771926.19 |

**Sample Problem 2:** Number Encryption

Krazy Kyndra wants to convert all of her coworker's data into leet speak in order to confuse them. Each piece of data that she is mixing up is a four digit integer. She needs a program that encrypts the numbers so they don't know what's going on.

Your program should read in a four digit integer and encrypt it to be h4xz0r 1337 in the following manner: Replace each digit by the sum of that digit plus 7, then modulus 10.

Then, swap the first and third digits, and swap the second and fourth digits, and print the encrypted integer.

Sample Data:

| Input | Output |
|---|---|
| 1009; | 7687 |
| 1234; | 0189 |
| 4491; | 6811 |

## 3.2. Motivation

The author's motivation behind organizing and delivering this competition are as follows:

- ***Getting RMU students engaged:*** It is important for RMU students to participate in extra-curricular activities to obtain engagement credits. This event provides a venue for obtaining such credits through event organization.

- ***Improving computing skills in high school students:*** High school students need to succeed, build teamwork, and improve computing skills. Participation in this event assists students' understanding of where they stand amongst their peers and the requirements of the competition help them understand few software engineering practices.

- ***Publicizing RMU and boosting enrollment numbers:*** It is felt that this competition will make more people in the region aware of RMU and what it has to offer. It hopes that such publicity will assist in boosting enrollment numbers.

### 3.3. Competition Benefits

The stakeholders in this event are high school students, high school teachers, undergraduate students, host institution faculty sponsor, and the host institution. The benefits of this event to these stakeholders are listed in table 2.

**Table 2: Stakeholders and Benefits**

| Stakeholders | Benefits |
|---|---|
| High School Students | • *Building teamwork:* Students follow a schedule, communicate & coordinate with their teammates, and work towards a common goal.<br>• *Succeeding:* This is an opportunity for the students to showcase their skills. This is the platform where the students can gauge their skills amongst fellow competitors by working hard to succeed.<br>• *Improving skills:* This is an opportunity for students to apply theory to practice, learn software engineering practices, and establish/build interest in the computing field.<br>• *Fun factor*: Besides working hard to succeed students also enjoy the company of other students (high school and college) in a university setting resulting in positive affect toward competition experience. |
| High School Teachers | • *Student recruitment*: In high schools programming classes are offered as electives. Teachers often have issues recruiting. Events like this motivate undecided students to enroll.<br>• *ACT credits* (continuing education requirements): A separate teachers program allows participating teachers to earn ACT credits. This assists in justifying to school administrators and boards why such trips are necessary. |
| Undergraduate Students | • *Skills:* RMU-ACM students are able to learn and practice skills like: organization, leadership, teamwork, conflict resolution, problem solving, and risk management.<br>• *Fun factor*: Besides working hard to provide high schools a well-designed and well-executed competition students also enjoy the company of other students (high school and college) resulting in positive affect toward competition organization experience. |
| Host Institution Faculty Sponsor | • *Interaction with high school teachers:* The event provides an opportunity for faculty sponsor to interact with high school teachers. Such interaction leads to exploration of possible collaborations. In the past the faculty sponsor has submitted a proposal to the National Science Foundation with participating high schools as implementation partners.<br>• *Personal gratification*: Meeting students who may consider the computing field as their career choice and discussing software engineering practices with them and their teachers provides a personal gratification. |
| Host Institution | • *Publicity and recruitment:* The event assists in publicizing the host institution. And the awards given attract students to consider RMU as a possible school of choice. |

***Promoting Software Engineering:*** In addition to the above listed benefits to the stakeholders this event also provides a platform to promote software engineering. At different stages of the event software engineering is promoted. The invitation letter briefly explains software engineering and also talks about coding as a phase in the Software Development Life Cycle (SDLC). Software engineering program at RMU is emphasized during the welcome and thank you speeches. The scholarships awarded to the winner are valid for software engineering enrolments. Software Engineering practices: flowcharts, pair programming, reviews, and testing are mandatory tasks of the competition. The author feels that multiple mentions of software engineering help promote software engineering among high school teachers and students.

### 3.4. Organization and Delivery

There are three activity phases to a successful programming competition: *pre-event, delivery,* and *post-event*. The faculty sponsor works with members of RMU-ACM to ensure all the necessary activities are executed in the order agreed upon and in a timely manner. Tables 3, 4, and 5 lists phase activities and owners.

### 3.5. Challenges and Results

To successfully "organize" and "participate in" an event of this nature various challenges are encountered by the stakeholders. In this section the author discusses different challenges from his understanding of the event. To strengthen the discussion wherever possible results of a survey questionnaire completed by 70% of past participating high school teachers are presented. This survey consisting of 23 questions, approved by RMU's IRB (Institutional Review Board), were sent out to 10 past participating schools.

- ***Getting RMU students involved:*** A key goal of this event is to get RMU students engaged. As this event is organized and executed by the Programming Competition Committee (PCC) formed from RMU-ACM members, under the guidance of the faculty sponsor, the students need to exhibit skills like organization, leadership, teamwork, problem solving, conflict resolution, and risk management. Some students are gifted with such skills and can immediately perform whereas other students learn on the job. In the five years of organizing this event students have been mentored by the faculty sponsor in the skills they lack. However as student bodies change every academic year, continuity in these skills has been a challenge to successfully organizing this event. In years one and two the faculty sponsor had to step in to ensure that the event was properly organized. However after the 2$^{nd}$ year the faculty sponsor introduced job shadowing. In this process senior/junior students take the lead roles and mentor freshman/sophomore as they execute their assigned tasks. This approach has ensured continuity in all areas of organization. Lack of student interest in the RMU-ACM chapter at times has also been an issue. In this case existing chapter students are given additional loads. On the eve and the day of the event required man power is fulfilled with "a call for volunteers" announcement and the response has always been overwhelming.

**Table 3: Pre-Event Activities and Owners**

| Activities | Owner |
| --- | --- |
| Form Programming Competition Committee (PCC) from RMU-ACM members | President RMU-ACM |
| Identify event date | Programming Competition Committee (PCC) |
| Prepare invitation letter | PCC |
| Inform administrators (Head of Department, School Dean) | Faculty Sponsor |
| Secure scholarships (for awards) | Faculty Sponsor |
| Book venue, Create room layout | Faculty Sponsor & PCC |
| Book computers, Secure IT support, | Faculty Sponsor |
| Install and test the testing software ($PC^2$) | PCC |
| Plan network layout, load image | PCC |
| Order/Buy meals | Faculty Sponsor |
| Order trophies, medals, prizes | PCC |
| Design certificates | Faculty Sponsor & PCC |
| Create/select competition problems | Faculty Sponsor & PCC |
| Gather raffle items | Faculty Sponsor & PCC |
| Gather registration information | PCC |

**Table 4: Delivery Activities and Owners**

| Activities | Owner |
| --- | --- |
| Register participants | PCC |
| Setup breakfast | PCC |
| Setup lunch | PCC |
| Welcome participants | Dean SEMS and/or engineering department head and Faculty Sponsor |
| Conduct event | PCC |
| Judge submissions | PCC |
| Identify winners | PCC |
| Notify winners | PCC |
| Conduct raffles | PCC |
| Present trophies/prizes | PCC |
| Conduct evaluation | PCC |
| Closing remarks | RMU-ACM President and Faculty Sponsor |

**Table 5: Post-Event Activities and Owners**

| Activities | Owner |
| --- | --- |
| Clean up Venue | President RMU-ACM |
| Deposit registration fees to RMU-ACM account | Faculty Sponsor |
| Send thank you email to participating schools | PCC |
| Send thank you email to organizers and sponsors | Faculty Sponsor |
| Send engagement credits to Dean of Student Engagement | Faculty Sponsor |
| Address participants questions, concerns | President RMU-ACM |
| Competition post mortem | Faculty Sponsor & President RMU-ACM |

- ***Getting high school teachers engaged:*** High school teachers accompany their students to the event. When the students are competing high school teachers need to be engaged. Some bring work with them however the majority are available to participate in other activities. Realizing this as a unique opportunity to interact with high school teachers, the faculty sponsor has developed a program for teachers where RMU activities are publicized and software engineering practices are discussed. Teachers are first met by science, math, and engineering department heads for about an hour where RMU activities are discussed. Faculty sponsor then spends an hour talking about software engineering practices which is highly demanded by the teachers as this earns them ACT credits (continuing education requirements). Coming up with a software engineering topic that is interesting and can be used in the high school is a challenge. So far the faculty sponsor has discussed software verification & validation, and inspection.

- ***Ensuring adequate programming environments:*** Participating students are taught in different programming environments and are knowledgeable in different programming languages. 35% of the schools surveyed used Visual studio, 25% used Eclipse, 18% used JCreator and the remainder used NetBeans, BlueJay and DrJava. Likewise 35% of the students were knowledgeable in Java, 29% in Visual Basic, 23% in C++ and the remainder in Python and Alice. Making such a wide variety of environments and languages available is a challenge. However the PCC has addressed this adequately. They share sample questions and solutions in all programming languages in their "call for participation" invitation and ensure all environments are available for the competition. 57% of the schools surveyed agreed and 43% strongly agreed with the variety of programming languages and environments provided for the competition.

- ***Providing attractive incentives to participants:*** For an event of this nature incentives are necessary for all stakeholders. For RMU students engagement credits are provided. For high school teachers free institute mementos are given. In addition whenever software engineering learning sessions are conducted participating teachers obtain ACT credits. For the participants two categories of prizes are available. Raffles are used to distribute items received from RMU departments and private sponsors. For the winners RMU scholarship offers are awarded. Such scholarships are valid if the participating student joins RMU. In addition trophies and gadgets are also given to the winners. For all participants breakfast and lunch are served. 57% of the schools surveyed agreed, 29% strongly agreed, and 14% disagreed with the prizes. Likewise 57% strongly agreed and 43% agreed with the food served.

- ***Ensuring logistics are taken care of:*** Invitation distribution, venue reservation, laptop imaging and networking, food, certificates, etc. are key logistics organizers need to take care of prior to and during the event. As students are responsible for many of these activities it is expected that some actions are not taken timely or are forgotten. Students utilize a check-sheet to ensure everything is executed as required. Table 6 lists the responses from the survey.

**Table 6: Logistics survey responses**

| Question | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | N/A |
|---|---|---|---|---|---|---|
| **I am pleased with the way that the conference is organized.** | 29 | 43 | 14 | 14 | | |
| **I am pleased with the way that volunteers support the competition.** | 57 | 43 | | | | |
| **I am pleased with the environment in which the competition is held (rooms, computers, etc.).** | 57 | 43 | | | | |
| **I am pleased with the registration process and package.** | 29 | 71 | | | | |

Some encouraging comments received from the teachers read:

- *Students enjoy the competition.*
- *Students appreciate the opportunity to see the campus and educational opportunities that RMU provides.*

- ***Costs and sponsors:*** For this event, cost is an important factor. However the faculty sponsor has always insisted this be a low cost event. Major cost item are event meals which average \$1.50 for breakfast (muffins, juice) and \$3.00 for lunches (sandwiches, pizzas) per participant. Other cost items are trophies and certificates. In the past for an event with average student participation of 45, average high school teachers of 10, and average RMU volunteers (including RMU-ACM members) of 15 the average cost of conducting this event has been \$700.00. The faculty sponsor has been able to obtain both in-house and external sponsors. The in-house sponsors are enrolment office, engineering department, SEMS, and SEMS-Outreach. Likewise throughout the years' freebies, software and cash from external sponsors like Eaton-electrical, ASUS, Mozilla, and Siemens PLM Software have also been received.

- ***Developing competition problems:*** The event is held in April of each year and the PCC starts developing the competition problems in late January. Multiple iterations are carried out to create a pool of 20 problems. At times RMU alumni (former RMU-ACM members) have also contributed to the problems pool. Some high school teachers have complained that the problems are not challenging enough and suggest that fewer problems be given. In response to their feedback in future events the number of problems will be reduced to six and consists of both easy and challenging questions. Each question will carry a full mark of 110 points where 10 is for flowchart and 100 is for the code. The competition time will also be reduced to 2 hours.

- ***Motivating success and building teamwork skills in high school students:*** Competitions provide a platform on which high schools can gauge how their students fare. The desire to win is one motivation. However RMU provides other incentives in the form of scholarships and prizes. To the survey question "In your view, does participation in the competition motivate your students to succeed?", 88% responded with a "Yes" and 12% with a "No". Likewise to the question "In your view, which aspect of participating in a competition motivates students?", learning to compete, awards, and food were the top choices. Being away from the school for a day, freebies, raffles, and being in a university were other selected motivations. To a question "In your understanding which benefits do you think your students have gained from attending the competition?", 28% responded teamwork skills.

- ***Enforcing software engineering practices:*** Based on time availability and completion possibility selected software engineering practices: flowcharts, pair programming, reviews, and testing are discussed. Using these practices is mandatory for the competition and the author expects this to help instill best practice among would be software professionals. To a question "In your understanding which benefits do you think your students have gained from attending the competition?" programming skills, testing skills, and design skills were the top skills selected by participating schools. To the question "One of the requirements in the competition is to draw flowcharts. Did you like that part?", only 50% of the participating teachers responded affirmative. The remaining 50% of the teachers had no clue on this requirement and it seems flowcharts are not part of their curriculum. For the next competition, the faculty sponsor will develop and share a short document titled "introducing flowcharts". The faculty sponsor has also offered to visit the high schools to offer short lectures on software engineering topics. The teachers are open to this idea.

- ***Judging Submissions:*** Points scored in the flowcharts and codes are used to determine the winners. A sample score sheet is shown in table 7. As explained earlier $PC^2$ is used as the judging software as it meets all requirements for this competition. However few high school teachers have been dissatisfied with the points deduction for incorrect submissions. Their argument is "*within the deadline my students submitted the correct answers even if it took multiple attempts; hence we demand full points*". It is felt that such thoughts are dumbfounded as the teachers do not realize that their students are able to succeed because of returns from $PC^2$ stating that their work is incorrect. RMU-ACM president is given the task to pacify disgruntled teachers and the faculty sponsor steps in only if the matter does not get resolved. Some teachers have also expressed that using flowcharts is not fair for the competitors. In the future, details of the $PC^2$ software with links to the $PC^2$ home page will be shared with the teachers.

**Table 7: Sample Score Sheet**

| Team | Code | Flowchart | Total | |
|---|---|---|---|---|
| Team 1 | 946 | 100 | 1046 | **1st** |
| Team 4 | 830 | 150 | 980 | **2nd** |
| Team 12 | 819 | 148 | 967 | **3rd** |
| Team 8 | 740 | 150 | 890 | |
| Team 2 | 731 | 150 | 881 | |
| Team 7 | 789 | 75 | 864 | |
| Team 6 | 740 | 100 | 840 | |
| Team 3 | 615 | 150 | 765 | |
| Team 13 | 577 | 150 | 727 | |
| Team 11 | 537 | 145 | 682 | |
| Team 5 | 585 | 85 | 670 | |
| Team 9 | 605 | 0 | 605 | |
| Team 10 | 537 | 0 | 537 | |

- ***Publicizing RMU:*** The competition has been instrumental in further publicizing RMU and its software engineering program. The event is publicized through an outreach center associated with the faculty sponsor's school, SEMS. SEMS-Outreach frequently organizes other competitions and has access to an area school database. A subset of this database (schools offering programming classes) is used for the invitation. RMU-ACM students also send invitations to their high schools. In addition to teachers and students talking about the competition at RMU, the programming competition scholarship awards are awarded to winning students in a formal awards night ceremony at their high schools. In a larger crowd RMUs name is resonated.

- ***Boosting RMU's enrollment Numbers:*** As of date the competition has not boosted RMU's enrollment number in the software engineering program. The author has observed that the enrollment issue is directly linked to the participating high school students' grade levels. In average 26% of the participating students have been seniors, 35% juniors, 22% sophomore, and 17% freshman. Pitching RMU as a school of choice to seniors is not an option. For sophomore and freshman it is too early. The target group has been the juniors. Scholarships would be the ideal motivation to attract them to RMU however the trend observed in the past 5 years is that teams comprising of seniors have been winners 95% of the time. Seniors could be made ineligible for the competition. However doing this would reduce participation as some schools offer programming classes only in the senior year. The personal gratification for the author is that students who have participated in the programming competition are encouraged to pursue a career in the computing field. To a survey question "In your understanding, what percentage of your students who participated in the programming competition chose (or are choosing) a computing degree as a career" 38% responded between 25% and 50%, and 25% responded more than 75%. The competition may not have boosted RMU's enrollment numbers. But it has been a small factor for student decision on higher education.

- ***Challenges to High School Teachers:*** Besides the organizers, participating school teachers also face challenges. When asked "what types of challenges they faced?" student skill level, gaining school approval, and transportation issues were at top of their list. The other challenge was managing time. To ensure maximum participation and minimum financial burden RMU-ACM charges a minimal of $8.00 per team as participation fee. At times when requests are made this fee has been waived.

## 4. Skills Gained

Besides competing in the event high school students also understand what it takes to be successful. They understand the importance of teamwork, communication, and technical skills. They understand that the event is the venue where they implement what they have been taught and what they have practiced for days in their schools. Students that are able to use these skills become winners whereas others realize their shortcomings. Based on the survey results high school teachers felt their students obtained programming skills, design skills, and testing skills. They also learned to respect other teams, depict professionalism, value teamwork, and get career ideas.

This event is also a venue where students learn about software engineering as a discipline and carryout short implementation of software engineering practices. Students understand what software engineering is and why it is important in the society today. They understand why and where flowcharts, pair programming, reviews, and testing are used in the SDLC.

## 5. Conclusions and Recommendation

In this article the author describes in detail how an annual programming competition is organized at RMU. An important motivation of this event is to make high school students aware of software engineering as a possible career choice. Short implementations of software engineering practices assist in instilling the importance of software engineering. The low cost event, organized by under graduate students and supported by administrators provides an opportunity for undergraduate students to learn event organization skills and for high school students to showcase their skills amongst their peers while using skills that are important for success. The author feels that an event of this nature helps spread software engineering knowledge and is an activity professional student chapters can easily replicate. For academic institutions and ACM student chapters [10] an event like this can serve two purposes – a doable activity and software engineering publicity.

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