TEAP Award Presentation

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INTRO: - MARK

First things first. Most of what we do in our Technology Education program at Lower Merion High School was borrowed or stolen from people who are much smarter than us. Some of those people may be in the room this afternoon, so…thank you. **<Slide 3 with "Thank You">**

Second, both of us despise talking about our program and if we had our way we would have our students up here talking to you instead. However if we went in that direction we'd have to have them complete all the permission slips for them to be here, provide transportation, feed them and then chaperone them. So, you'll have to listen to us instead. And for that, We're sorry. **<Slide 4 with "Sorry">**

MARK: Third, in order to understand why **we're** standing up here this year you have to understand our approach to organizing and implementing our Tech. Ed. program. As we've already said we've borrowed or stolen from people who are much smarter than we are and maybe some of it is just plain luck. But parts of it, we'd like to believe has to do with our philosophy towards education, specifically Technology Education.

RICH: And this is how we'd like to share our time with you this afternoon -giving you what we believe is "working" for us in our quest to inspire students in STEM and increase their technology literacy. We originally had these grand ideas and power point slides of how each lesson and activity that we teach is connected to state and national standards, but to the dismay of maybe some of you, we're not going to go in that direction.

BODY:

RICH: <Show slide 5> You'll notice that our slide and display board has stuff on this side and then more stuff on the other side, and then these governing ideals in the middle that permeate through all the stuff on both sides. What we'd like to do is take each of these governing ideals and show how we've attempted to implement them into each side – co-curricular stuff and the curriculum stuff. Why focus on these governing ideals? Well look at it this way…

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In a robotics competition, TSA event, or classroom challenge we are often asking our students to develop a vehicle to deliver a payload to a target. Get the balls into the goal – it's what we do.

<Slide 7>

Using this metaphor the traditional model for us as educators is to prepare our students to meet our target of technology literacy set forth by PDE and ITEA. The students being the vehicle the payload being the standards and target being the technology literate students.

This works well if our only goal is deliver this standards payload without any concern for the people and the outcomes of **their** technology literacy – in other words **the students'** targets beyond the classroom. We could very well end up producing classrooms full of students who excel in every standard under the sun, but at what cost? Without the center column, we don't know if we're producing technology literate dangers to society or technology literate people who are solving societal needs and real world problems that help humankind.

<SLIDE 8>

Einstein … a man way smarter than we are … once said this ……. "If only I had known, I should have become a watchmaker." He talks about the "way of thinking" being more important than the science and technology. Well folks, if we don't learn from this piece of history, we'll most certainly repeat it.

Quick Case study: In less than one school year we were able to teach students how to build a 120-pound vehicle to autonomously seek a target, determine friend from foe and deliver a payload. You've probably seen Alice in our display. If any ONE of those students decided to go on do something harmful with that skill and knowledge, we have to partially accept that blame because we were the ones who initially and intentionally inspired them to learn that skill set. Sobering thought.

MARK: **<Slide 9>** So let's start with our first governing ideal; paraphrased from Dr. Woodie Flowers, Professor Emeritus of mechanical engineering at MIT. Professor Flowers was in a conversation with Dave Lavery, Program Executive for Solar System Exploration at NASA Headquarters. **<Slide 10>** In this conversation, Mr. Lavery was mentioning to Dr. Flowers the unexpected accomplishments of one of his robotics competition mentees (a former student). Flowers responded to Lavery, **"It's not about building robots, it's never been about building robots. It's always been about building people. Build the people; they'll take care of the robots for you. That part will happen all by itself."**

At this point we anticipated that some of you may be looking at us like we've got two heads. "What are they talking about – take care of the people? I've got standards and benchmarks to address. I've got papers to grade, 300 emails in my inbox and modules to repair."

Well, when we say take care of the people, we're not talking about starting every class or club meeting with group hugs or passing out doughnuts. We're talking about a personalized approach that involves listening to the students, modeling behavior and, as much as possible, showing them how their technology skills and knowledge can have a positive impact in their school, community, and the world at large – and giving them opportunities to do so. In other words, exposing them to curricular and co-curricular activities that emphasize social consciousness and community awareness.

Some of our greatest success stories – our **students'** success stories - come out of our club – while others come out of our courses – some are a result of both. And, sometimes it's hard to determine which one was the impetus of the success – the courses or the club. Either way, we ideally prefer a symbiotic relationship between the club and the courses. However often the members of our club are the early adopters of the middle column **<show slide 11>** they get it - and their passion and influence permeates into the rest of the club and our classes. They also inspire **us** because through them, we are able see the fruits of our collective labor.

From our club roster, here are some of our finest examples of this ideal, "Take care of the people, and they'll take care of the machines:"

RICH – Phil Ross: **<Slide 12>** 2009 graduate on his way to the University of MD who was both a TSA Officer and Dawgma Captain and took several Tech Ed courses. Not only did his technological competence increase in CADD & Mechanical Design, but the ideals and leadership opportunities he learned with us have led him to serve FIRST in the Philadelphia Region as part of a VISTA program – earning a stipend to support K-12 STEM in our area and beyond. He is by far the youngest person to ever be selected for such a position anywhere in the country.

MARK – Jessica Scolnic: **<Slide 13>** Former TSA Chapter officer, PA TSA state officer and Dawgma team member. Jessica took it upon herself to organize and run a Jr. FIRST Lego League challenge in her community for elementary school children ages 6 to 9. She did this for her senior project and as a result helped inspire about 50 children in STEM. She also publishing a "how to" guide for other communities to follow. Jessica is currently studying at Tufts and our club plans to continue on with her legacy by offering another Jr. FLL challenge this fall.

MARK – Dan Zollman: **<Slide 14>** Former TSA Chapter President, former state TSA vice-president. He took all five of the Tech. Ed. courses at LM. He is currently pursuing a degree in Industrial Design at Rensselaer Polytechnic Institute (RPI). Dan took the initiative to author of the new PA-TSA Inspiration Award and have it approved at the state TSA level. This award was designed to recognize TSA chapters who build relationships with their communities, engage in

service projects and make social conscious activities a high priority. This is the first year that TSA chapters in the state of PA can apply for this award.

RICH – Chuck Glick: **<Slide 15>** Part of Dawgma Robotics for three years and a Tech Ed student. He developed solid mechanical design and CADD skills and used it as motivation to go on to study Mechanical Engineering at Drexel. Chuck continues to volunteer at local robotics events to support STEM and he openly speaks about his experience with our club as being the reason he is a college student studying engineering.

Coming back to our ideal, **<slide 16>** "Take care of the people and they'll take care of the machines," we take this into the classroom also. I guess our greatest examples of classroom student succeses are people like …

RICH - Zac Cohen: **<Slide 17>** Some of you MU people may recognize Zac. He is a graduate of our program and our club. He returns during the FIRST Robotics build season to volunteer and serve as mentor to our students. Zac is currently pursuing a Bachelor's in Education with a Technology Education certification and credits his experience with us as the reason he is on this career path.

MARK - Matt Piccolli: **<Slide 18>** Matt was a veteran of all of our Tech. Ed. courses at LM and participated in TSA at least one year. He just graduated with a degree in engineering and is currently pursuing his Masters degree in engineering. His list of cool accomplishments is too long so I'll just focus on some of my favorites. Matt joined the Formula SAE race team (Society of Automotive Engineers) and interned at robotics company called Willow Garage. He's come back to speak to our students a couple times about his experiences in robotics and the SAE. He told me that when he comes back this fall, he wants to talk about leadership in engineering.

MARK - Jim Littlewood: **<Slide 19>** Jim is a veteran of all our Tech. Ed. courses. He wasn't involved with our club at all. As juniors at LM, Jim and Matt, who were close friends, were not satisfied that we only offered two courses in CADD, so they basically stalked and harassed me until I offered an independent study course in CADD. I had them do all the paperwork at the district level and participate in the presentations in front of the curriculum committee. They even contacted the Pro Desktop software people to get free versions of their software for our lab. Since them we've moved to Autodesk software and our Pro Desktop license is now being used at the middle school level inspiring engineers at the middle school level. Jim is currently

working for NETZSCH, Mechanical Engineer. The company is based in Germany and they make progressing cavity pumps. They are commonly used in the food, industrial and municipal fields.

These are just some of the people that we've attempted to take a vested interest in and encourage their dreams and desire to pursue STEM to one degree or another. We not only want to support their endeavors, but we want to celebrate them.

RICH - **<Slide 20>** A few years ago we developed a Mission statement for the club. We had to. We had a TSA chapter, a VEX team, & FIRST Robotics – kids and people all over the place - and we had to identify some common ground and vision, because although we are three entities in one, we are actually one club with the same purpose. One year we had our students (after reading our mission statement) create their own individual mission statements, and then share it with the rest of club. We also created a club organizational chart **<Slide 21>** to help organize the operation. It's one of the first documents that we share with our students at our first club meeting. **<Summarize organizational chart>** And that brings us to the second of our governing ideals **<slide 22>** the middle column – **"us versus the problem."** The separate branches within one club can sometimes conflict and clash with one another. We experienced this and had to address it. So as you'll notice here (in the chart) **<show slide 23>** that we have crossover teams and we offer after school leadership training to the officers/captains of TSA, VEX, and FIRST together. This leadership training takes place at the end of the school day and it is an opportunity for students to learn about real leadership skills. We use materials from Max Depree – Leadership is an Art, books by John Maxwell and Jim Collins, the Last Lecture by Randy Pausch and other sources. Once they get the message that we're in this together they send the message **and model** the message throughout the general membership of the entire club, which filters into the classroom as well. All of our fund raisers, community service events, outreach program, field trips, involve members from across all three branches of our club. We've posted our vision statement and we make sure that students are aware of it. We want them to see the big picture.

MARK - When it comes to Us versus the Problem ideal, **<slide 24>** in our curriculum, we've attempted to implement this ideal on a couple different levels. At the teacher level or the professional development level, we've attempted to bring in genuine STEM integration by bringing in colleagues from other disciplines to help with written content and delivery of our course content. Specifically we've recruited one of our physics teachers to look at our curriculum and course activities to see where we can make improvements in delivering

mathematics. It helps that this individual was a former engineer and helps advise our VEX robotics team. The two of us have built-in collaboration time where we can brainstorm together and play with ideas.

At the student level we implement the Us versus the Problem ideal into the design and construction of our projects. When students are given a project such as a mousetrap vehicle or robotic system, we initially have them brainstorm individually and then we have them share their ideas within a small group to improve and refine their ideas and then we have them participate in a design review where all students can see all the ideas of their classmates. They are still responsible to build the device individually, but the brainstorming and actual design can be a group or even entire class experience. They still compete like crazy, but they know that they are in this together – us versus the problem. Their focus shifts from an anxiety filled selfish approach to a collaborative team problem-solving approach, which is what engineers do in the real world.

RICH - **<slide 25>** The next two items in the middle column are **"Design is an iterative process" and "Failure is not terminal."** If you're in our lab you hear Mark and I say these weekly if not daily. And then the cool thing is when you hear students say it. More importantly is when you see students *demonstrate* its meaning. Our students live in a world of instant gratification and get-it-done-yesterday mentalities. Looking at design and systems through the lens of iterations can be a new concept for them. Getting them to understand that products, services, and life in general are not things that happen successfully over night can be a daunting task. On our quote board in the lab, where we let students write down express funny or cool things that have been said throughout the years, some of our students have applied the "Design is an iterative process" statement in their own way. **<Slide 26>** "Dating is an iterative process." "Living is an iterative process." While this is humorous, it's also an indication they are internalizing an engineering concept into their own lives. And we want to celebrate that. That's true learning. **<Slide 27>** Barbato Slide – (explain on screen)

<Slide 28> "Failure is not terminal" is just another way to reinforce this concept of iterations. We want our students to understand, appreciate and exude this idea of ongoing process and improvement ---

MARK - "Design is an iterative process" and "Failure is not terminal." As Rich said, "Failure is not terminal" is just another way to reinforce this concept of iterations. We've noticed that some teachers assess their design projects by the end result that the student receives in a class competition. Get your robot or mousetrap device to shoot the ball into the

goal if you want get the "A" - kind of like Ski Ball at the arcade. This concerns us. We're not saying that we don't want our students to give us their best and strive for the bull's eye on the target, but we prefer them to *assess them on the process and meeting design specifications*. Some students are going to do incredible work with their research, drawings, documentation, but still not have their device or robot, meet the ultimate goal on the competition field. Why should we punish them with a poor grade? Failure is not terminal – as long as you learn from it. It's how they got to the result (the process) that is important. We not only expect failure to some degree we design it into our activities. And our students are required to document their failure in their design and engineering notebooks and in their final project presentations. How did the failure happen, why it happened, what, if anything did they do to address it. One of the awards we give out after each design challenge in our courses is called the "First Penguin Award." This award was taken directly from Randy Paush's, *The Last Lecture*. Dr. Paush gave out the same award to his student design teams at Carnegie Mellon that took the biggest gamble while not meeting their project goals. The award came from the idea that when penguins jump in water that might have predators, well, one of them has got to be the first penguin. In essence, it is a prize for "glorious failure." From Paush's book, "Experience is what you get when you don't get what you wanted. And it can be the most valuable thing you have to offer. Failure is not terminal – as long as we learn from it.

RICH - <Slide 29> Social Consciousness refers to an awareness of the problems that different societies and communities face on a day-to-day basis; to be conscious of the difficulties and hardships of society. The way we look at it this is really old PA standard 3.8.12B: "Apply the use of ingenuity and technological resources to solve specific societal needs and improve the quality of life." We noticed that this particular standard was reworded in the latest draft of new standards. We know that this is a transition, but hope that the essence of the standard is kept because it just may be the most important Technology Education standard that we have to pursue. This is the one standard that drives us and gives US a purpose for showing up every day. If you're letting modules, software, master projects and even standards solely drive what you do, then you're no different that the teacher down the hall that's using their textbook as the center of activity. You just have a "cooler" textbook. Remember Einstein as a watchmaker. Think about it. Technology, innovation, & invention without a social conscience will merely allow us to destroy ourselves in more creative ways. This is one area where our club members have really grabbed the bull by the horns. We gave them a few different opportunities to demonstrate their social consciousness; how their skills, knowledge, and technology literacy

can be used to solve societal needs. After awhile, they started coming to us with ideas. Here are just a few examples:

Engineers without Borders: **<Slide 30>** I think Sylvia Herbert is the student who inspired us to get involved with EWB. If you're not familiar with EWB, they are a non-profit established to partner with developing communities worldwide in order to improve their quality of life. They have come to speak to our students and a portion of our fund raising goes to EWB. Some of our graduates have joined EWB chapters in college.

MARK – Josh Hoffman: **<Slide 31>** Josh is a current TSA member and Josh knows out to stir the pot –for good reasons. He is very concerned about the environment. Josh made it is goal to get the single sided rule at states overturned at also at the state and national level. Up until now students were required to submit their notebooks on single sided paper. He wrote a document arguing the cause of printing double-sided for TSA events and submitted to the CRC. We recently learned that BOD is considering his proposal. He's been in contact with Rosanne White and Bill Bertrand at the national level and is waiting to hear if it will be overturned at the national level. Josh was recently inducted into the PA-TSA Environmental Committee.

MARK - Aniqua: **<Slide 32>** TSA chapter officer volunteered this summer with a Grameen-Veolia Water Ltd., which supplies water to the poorest people of Bangladesh. The goal of the organization is to rescue the rural people from energy poverty which hampers their social and economic development.

RICH - Portable Inspiration: **<Slide 33>** Portable Inspiration is a STEM outreach program with multiple learning stations related robotics, problem-solving, teamwork, simple machines, etc. We developed this with our students and other than giving introductions, it is completely run by the students. It has been used in three different school districts, including our own, the boy scouts, at a local karate studio, and as part of public demonstrations and fundraisers. In all, we've delivered hands on STEM experiences of all kinds to thousands of people. **<Slide 34>** A few of our students and I even co-authored an article about Portable Inspiration and the necessity for STEM outreach that was published in a recent edition of The Technology Teacher – that how important we believe it is.

RICH- Ulster Project: **<Slide 35>** The Ulster Project is dedicated to promoting a peaceful parity of esteem between Catholics and Protestants in Northern Ireland by building tolerance, trust, and ongoing positive relationships among potential leaders from "both sides" of the ongoing conflict. Every summer groups of Irish students travel to several US cities as part of Ulster. In DE, 20 Irish students (half Catholic and half Protestant) come to participate in a host of activities. One of the activities is a one-day robotics build, design, cooperate, and compete workshop aimed at team building and developing a socially conscious interest in science and technology. Co-hosted by the MOE Robotics team from Wilmington DE and our Dawgma team members, our students serve as "expert mentors" working with mixed Irish teams of Catholic and Protestant students as they build their machine to accomplish a game challenge.

MARK - Social Consciousness. **<Slide 36>** Our best example of a curriculum project that involves social consciousness is our IED Clean-Up activity that we've implemented into one of our courses. **<Slide 37>** The IED Clean-Up is an activity where students initially work in pairs to design robotics systems to remove simulated IEDs (improvised explosive devices) from a simulated post war era scenario. Students can relate to this because they are seeing it on news weekly. Although they work in pairs, the entire class has to work together to come up with complimentary designs and a strategy to remove all of the IEDs we put out in a given amount of time. This is real social consciousness – showing students how their skills, knowledge, their technology literacy can be used to solve specific societal needs and improve the quality of life.

We've also used a project in our engineering course where students use robotics, pneumatics, electronics, CADD, and rapid prototyping to design and build a fully automated pneumatic can crusher. The social consciousness connection here is the environment – going green.

RICH: Gracious Professionalism <Slide 38> is a term coined by Woodie Flowers which supports respect towards one's competitors and integrity in one's actions. You see these words on pins, shirts, and banners at FIRST events, and Dean Kamen and Woodie Flowers always find a few opportunities to share the meaning of these words at national competitions. It only made sense for us to continue its use from the FIRST competition field into our club and then again into our classroom.

<Slide 39> One example of this ideal of Gracious Professionalism is when our TSA officers and robotics captains (on their own initiative) created CDs that had a variety of helpful files/documents for new participants and distributed them out to the new TSA chapters at that state conference and new teams at FIRST events.

Gracious Professionalism <slide 40> may be the hardest one to implement into the classroom because we don't have a Woodie Flowers or Dean Kamen with us there. Although the term is hard to define, it is easy to see when it is in front of you. And we're experimenting with some ideas. All of our students in all of our courses are required to keep design & engineering notebooks. And when they get help from a classmate or competitor in a competition, we require them to document who gave them the help in their design and engineering notebook. We then give out a Gracious Professionalism award at the end of the competition or challenge for the individual or team who helped out an opponent the most. We encourage our students to compete like crazy, but be respectful in the process and demonstrate appropriate sportsmanship.

MARK - Conclusion:

Before we wrap things up it wouldn't be right if we didn't talk about the weaknesses of our program, or our failures…because our failures are not terminal and we enjoy learning from them. And not only is design an iterative process, but teaching is an iterative process also. So in attempt of full-disclosure here we want to tell you that we're still learning. Many of you are doing things we're envious of. We've also realized that if we're going lay claim to the T & E in STEM, we've got some work to do. We're not engineers. We're Tech Ed. teachers and although there are similarities we recognize that to teach the engineering process at the high school level, we've got to know more about engineering, we've got to implement more cross-discipline content into our courses, so we're working on that. Fortunately there are resources that we're adapting into our curriculum, such as the CATTS materials and recent document from the National Academy of Engineering that was released last month. And the ASEE (American Society of Engineering Education) just released a learning kit and a brand new website.

RICH – **<Slides 41 & 42>** – Those resources and others pertinent to our program and presentation are available here (refer to slides) and the entire presentation is available for download at the address here. **<Slides 43>**

Finally, we'd like to thank TEAP for this opportunity, our colleagues, supervisors, our wives and families, and our students. There are a whole host of people behind the scenes that make us look good and we couldn't do it without them. As we started off, we've taken a great deal from people who are much smarter than us and we look forward to the future. To be continued. Any questions? **<Slide 44>**