

The 21st Century Polytechnic University

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Why Change?

INDUSTRIAL AGE VS. DIGITAL AGE

THE WORLD HAS CHANGED

- The dawn of the 20th century and the emerging industrial economy demanded that American colleges evolve from a curriculum that had focused almost solely on preparation for a handful of professions.
- Entirely new higher-education institutions were started with the intention that disciplines like engineering, education, and architecture were subjects and majors that students should pursue in college.
- More than a century later, higher-education institutions find themselves in a similar situation.
- This time it's the digital economy instead of the industrial economy demanding a new set of skills.
- The problem is that the taxonomy of academic majors that broadened significantly over the past hundred years can no longer keep pace with the churn of knowledge needed to compete in nearly every profession.

GAME CHANGERS

HARMONIZATION AND INTEGRATION OF MANY DISCIPLINES AND DISCOVERIES

- Various titles: Fourth Industrial Revolution, Second Machine Age, Digital Convergence, Industry 4.0
- Characterized by the convergence/integration of:
 - Artificial Intelligence (AI)
 - Internet of Things (IoT)
 - Cloud Computing
 - Data Science and Analytics
- Fusion of technology across the physical, digital, and biological worlds

INDUSTRIAL AGE TEACHING AND LEARNING

WHAT NEEDS TO CHANGE

- Structure and curriculum have not kept pace with the evolution of business and industry and technological progress
- Education is too much like the world of work of the industrial age
 - Punctuality, attention, and silence
 - Standardized tests
 - School is managed for the students
 - Students are rewarded for having answers, not asking questions
- Life after school demands self-directed learning to prepare graduates for jobs that do not exist today.
- Digital age graduates must navigate the ambiguity of today's jobs with a mix of discipline knowledge/skills and "refinement skills" of communications and writing, creativity and problem solving, and working in teams.

THE CONSTRAINTS OF A MAJOR

ACADEMIC DEPARTMENTS ARE ALSO CONSTRAINTS

- Burning Glass Technologies showed in a 2015 report, so called hybrid jobs — which require a set of skills that aren't as neatly packaged as a major in college — are growing quickly.
- The future of work calls for something more radical: the elimination of academic majors as we have come to know them.
- While cross-disciplinary research has long been a focus of many scholars, majors for the most part continue to be controlled by departments that are cut off from one another.

TRANSDISCIPLINARY STUDIES

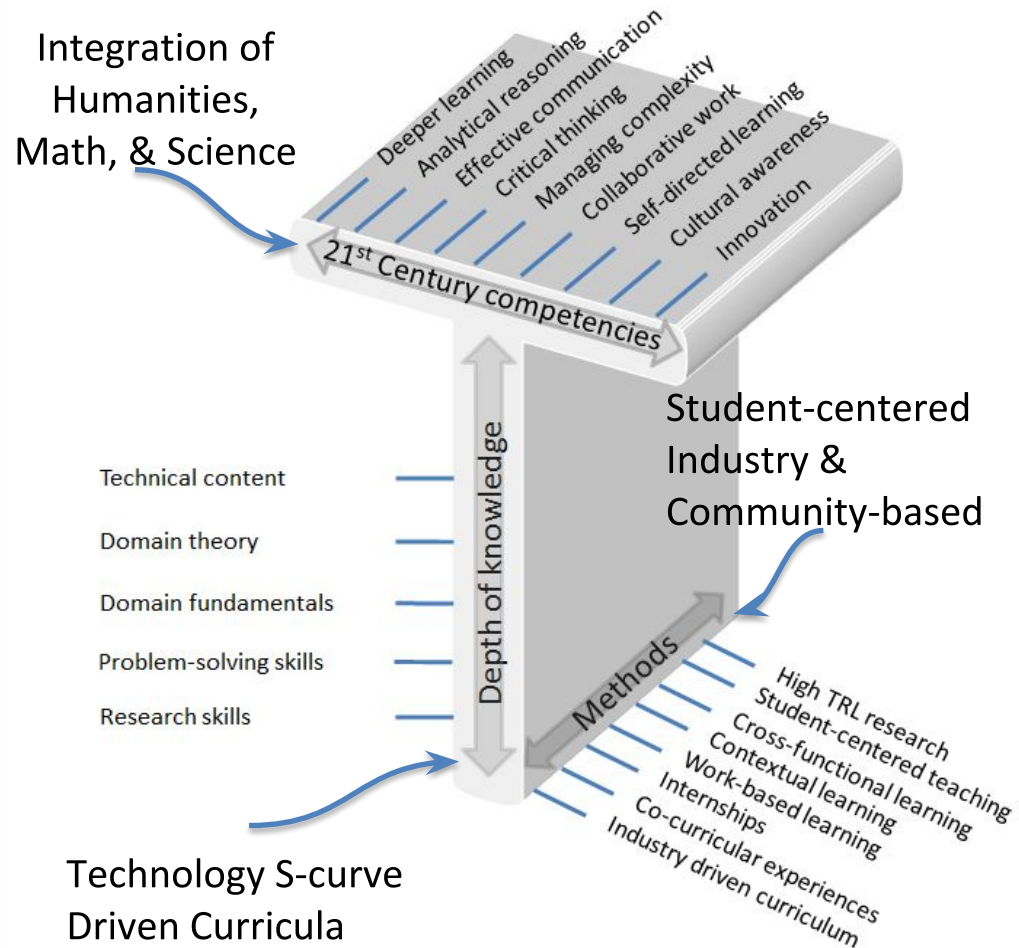
SPANS DEPARTMENTS AND MAJORS

- One urgent need is to make what students study in college truly span all academic disciplines.
- Right now, in choosing a major, undergraduates automatically narrow their focus at a time when they need both breadth and depth.
- The learning that is called for has been referred to as T-shaped: The vertical bar of the T represents deep understanding of one subject (the current conception of the major).
- Just as critical is the horizontal stroke, which allows people to work across a variety of complex subject areas with ease and confidence.

PREPARING THE T-SHAPED PROFESSIONAL

MULTIDIMENSIONAL AND INDUSTRY-READY

Combination of deep "vertical" knowledge in a particular technical domain with a broad set of "horizontal" skills such as teamwork, communications, competence with data and technology, and advanced literacy skills



HUMANICS

TECHNICAL, SOCIAL AND DATA SKILLS

- Joseph Aoun, president of Northeastern University, in his book *Robot-Proof: Higher Education in the Age of Artificial Intelligence* (MIT Press, 2017), has suggested a complementary learning model that he calls "humanics."
- Blends technical, social, and data skills, and, in the process, develops "higher-order mental skills".
 - critical thinking, systems thinking, entrepreneurship, and cultural agility.
- Create clusters of study designed around the most challenging problems facing the world.

EXPIRATION DATES ON MAJORS

5-YEAR REVIEWS

- Another key reform is to put an expiration date on these new pathways of learning.
- Colleges are adept at starting majors but almost incapable of stopping them.
- Each new cluster of knowledge should be reviewed every year for necessary changes and every five years to determine if it should be dissolved or extended.

DECREASING CREATIVITY

DISCIPLINE'S PRIMACY OVER CREATIVITY

- There is a deep mismatch between the skills our education systems nurture and the needs of society.
- In a typical Western education system, results indicated that “since 1990, even as IQ scores have risen, creative thinking scores have significantly decreased”.
- Traditional education does not sufficiently value innovative and entrepreneurial thinking.
- Our system even dumbs down the creative genius that we were born with, according to a test developed by NASA.

NASA STUDY

CREATIVITY; WHAT HAPPENED?

- In 1968 researcher George Land devised a creativity test for NASA to help select innovative engineers and scientists.
- He tested all the scientists and engineers at NASA and found that only 2% of NASA's scientists measured at the genius level for creativity.
- Later George Land conducted a research study to test the creativity of 1,600 children ranging in ages from three-to-five years old who were enrolled in a Head Start program.
- Guess the percentage of children in this age group that measured as genius?

NASA STUDY RESULTS

- He re-tested the same children at 10 years of age, and again at 15 years of age.
 - Test results amongst 5 year olds: 98%
 - Test results amongst 10 year olds: 30%
 - Test results amongst 15 year olds: 12%
 - Same test given to 280,000 adults: 2%
- **“What we have concluded,” wrote Land, “is that non-creative behavior is learned.”**

Top 10 skills

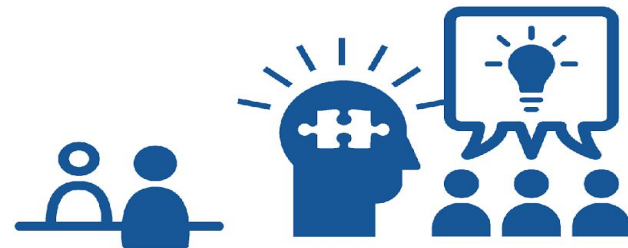
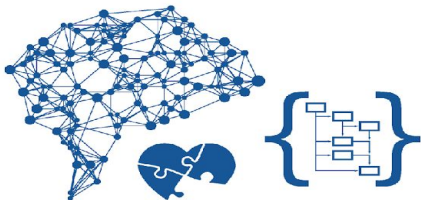
in 2020

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgment and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility

in 2015

1. Complex Problem Solving
2. Coordinating with Others
3. People Management
4. Critical Thinking
5. Negotiation
6. Quality Control
7. Service Orientation
8. Judgment and Decision Making
9. Active Listening
10. Creativity

You do not learn these skills sitting in a 50-minute lecture



ENTREPRENEURIAL EDUCATION AS SOLUTION



Entrepreneurial education teaches the important skills of innovative and creative thinking, helping people develop a flexible “growth mindset” that can adapt to new problems.

ENTREPRENEURIAL EDUCATION

- According to the European Commission's new Entrepreneurship Competence Framework, entrepreneurial education includes life skills as well as business skills.
- It means learners can act upon opportunities and ideas and transform them into value for others, whether financial, cultural, or social.
- Despite the importance of this mindset, according to a 2016 Eurydice study,
 - no country has made entrepreneurial learning mainstream within education,
 - no country effectively assesses student learner outcomes,
 - and few countries have embedded experiential learning to develop this mindset and skills.

TEACHING CREATIVITY

DEEP LEARNING

- Currently, creativity is often limited to one-off activities such as brainstorming or mind-mapping.
- Research into creative mindset development indicates a minimum of four to six months' continuous development is required to develop creativity.
- Ideally, this learning should extend across the whole age range of formal and non-formal education.
- Established entrepreneurship education programs prioritize experience of the business start-up process.
- Education neuroscience indicates that without a sustained deep-learning approach, the levels of creativity will continue to fall as children progress through formal schooling.
- Prevalence of competition-based formats linked to start up or business ideas is detrimental to learner development in terms of self-belief, entrepreneurial skills and ethics.

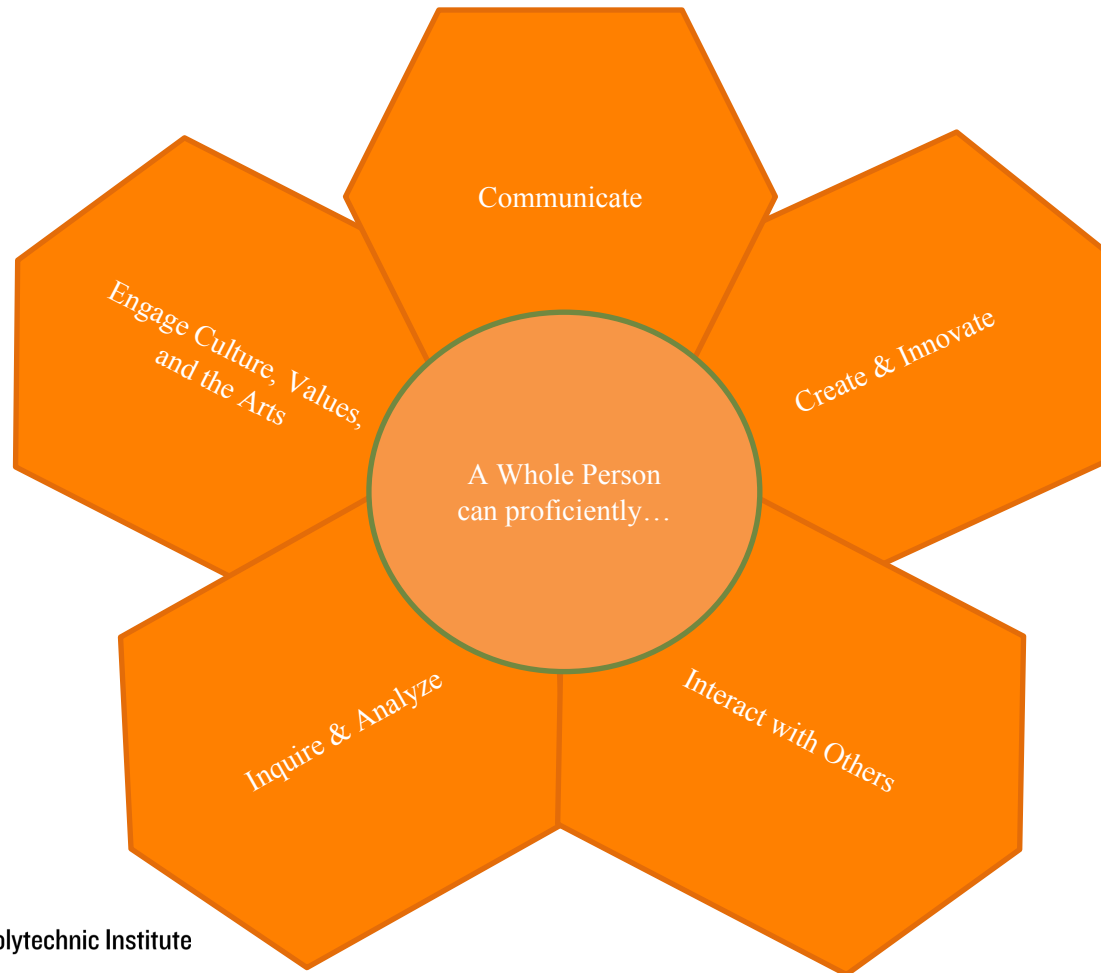
TST DEGREE PROGRAM

NEW COMPETENCY-BASED BS DEGREE PROGRAM

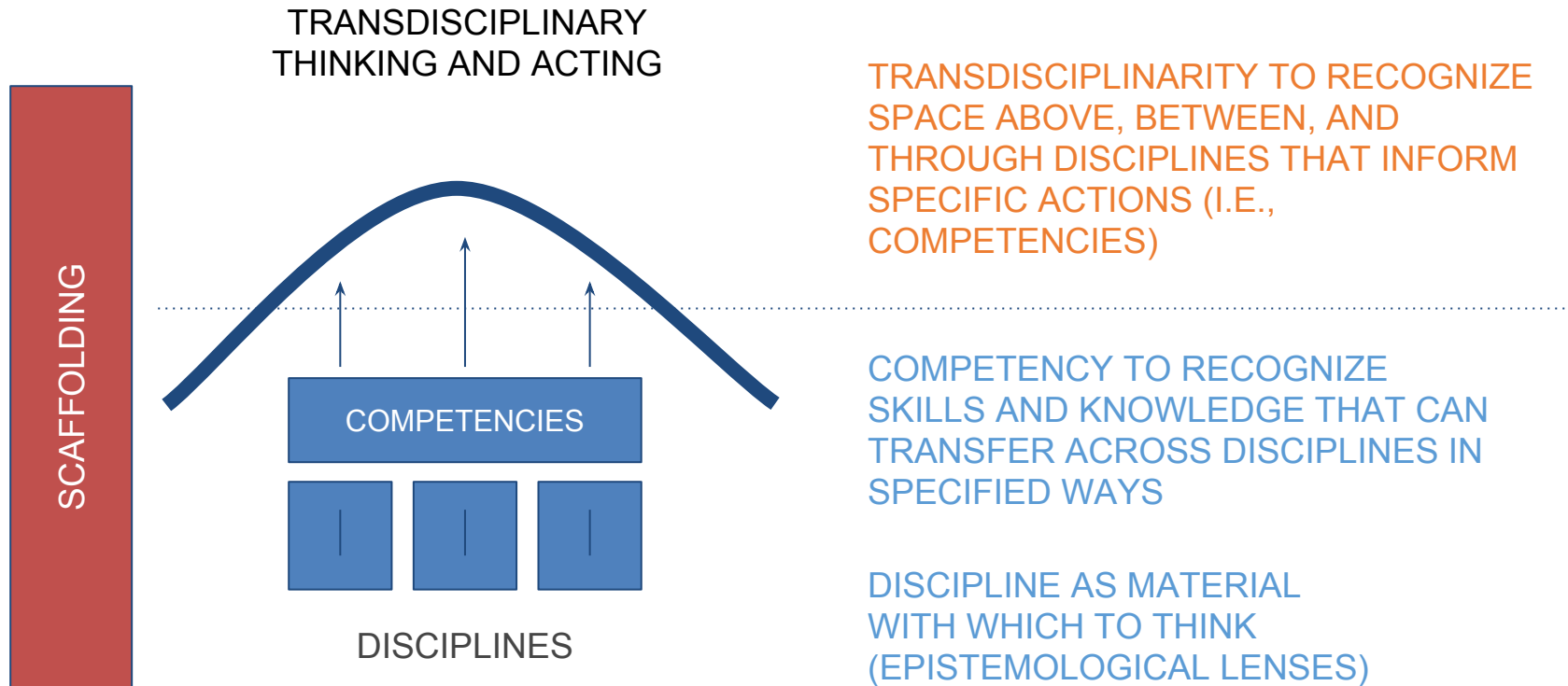
- The TST program prepares students for addressing complex/integrated systems they will encounter in life and work, with a central challenge of maintaining their own well-being and self-regulated learning, adaptation, and resilience.
- Students will learn a “multidisciplinary approach to the analysis and solution of complex problems,” including the problem of how their interests and education relates to a dynamic society and career goals.

FIVE PRIMARY COMPETENCIES

TST students are required to demonstrate five primary competencies (abilities) that contribute to their ongoing development as an adult, and that will aid them in a range of work and life activities over time.



CURRICULUM MODEL



TEN ELEMENTS OF TRANSFORMATION

Requires significant advancements within each element, not minor evolutionary changes

Theory-Based Applied Learning	Learning-by-doing is core to the Polytechnic experience & requires an increased use of lab courses and/or in-class applied-learning activities
Team Project-Based Learning	Responding to industry, more team project-based learning is needed, and this should also include instruction on team dynamics/techniques
Modernized Teaching Methods	Improve student learning by replacing less effective traditional lectures with “Active Learning” methods – see “Cone of Learning” on CIE web
Learning in Context	Provide a richer learning experience via a purposed-based, just-in-time manner – requires inter-disciplinary synchronization – very challenging
Integrated Humanities Studies	Adjust courses/curricula to reap benefits of studying humanities within STEM framework; integration with TECH 120 is a model for years 2, 3, 4
Competency Credentialing	Create competency-based majors or degree programs by leveraging work done for college’s recently-approved transdisciplinary degree
Senior Capstone Projects	All plans of study should include a required two-semester senior capstone experience that is driven by industry or community partners
Internships	All degree programs should include a required internship or other workforce-like activity that is facilitated by the college and department
Global/Cultural Immersions	All plans of study should include a required activity that gives students an enriched perspective of the cultural-driven global marketplace
Faculty-to-Student Mentorship	A hallmark of the Polytechnic experience is the opportunity for every student to have a faculty mentor for professional guidance & support

EDUCATE THE WHOLE PERSON

1. Experiential learning that embeds the learning experience in authentic, relevant contexts.
2. Develop a culture in which critical thinking and collaboration can be taught in the context of a multicultural world.
3. A new whole-person curriculum that emphasizes interpersonal and intrapersonal dimensions of education in addition to cognitive dimensions.

NEW TEACHING FORMATS

1. Microcredentials to measure learning of experience and achievement.
2. A system of minimester classes that allow students to replace three-credit-hour classes with more granular and flexible modules.
3. A new competency-based learning unit of measure by demonstrated competencies and skills.
4. A decentralized transcript and e-portfolio students to combine evidence of learning and achievements into credentials that are relevant to potential employers.

PERSONALIZED LEARNING

1. Mastery-learning and adaptive-learning platforms that allow customized delivery of learning materials for the students.
2. Personalized and multifunctional tutors to take advantage of advances in AI to push the envelope in personalized learning.

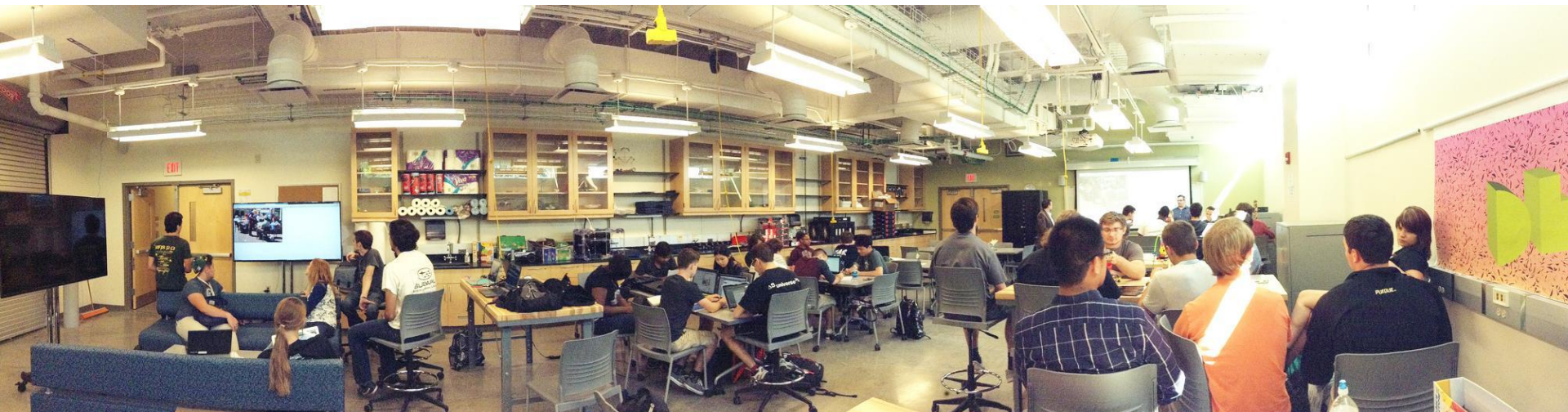
DISTRIBUTED GLOBALIZATION FOR LEARNING

- Living Library for Learning to provide access to experienced individuals that relate to class topics and individual learner needs.
- Virtual Learning Labs are scalable virtual gathering places, portals, and learning spaces with global educational partners.
 - Faculty shared between partner universities
 - New faculty designation – Global Professor
 - Student projects/minimester classes with global educational partners.

WHY POLYTECHNIC?

UPDATED DEFINITION

- The 21st century version of the Polytechnic:
 - New discipline for the thinking and creative economy
 - The T-shaped professional
- Our new definition of “polytechnic”:
 - A college that uses innovative learning methods, real-world experiences, and industry partnerships to produce graduates uniquely qualified for STEM professions



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