Strategic Workforce Initiative (SWI) Proposal—Computer Science

Partnership—Weber State University (WSU), through the College of Engineering, Applied Science & Technology (EAST) and the School of Computing, a departmental unit within the college, which includes ABET accredited Computer Science, is applying for Strategic Workforce Initiative funding for a cooperative project between the following education partners:

- Weber State University—Dean David Ferro, College of Engineering, Applied Science & Technology; Dr. Brian Rague, Department Chair, School of Computing
- Davis School District—Mike Parker, CTE Information Technology
- Morgan School District—Robert Kilmer, CTE Director
- Northern Utah Academy for Math, Engineering, and Science (NUAMES Charter School)—Deb Hefner, Director of Business Operations
- Ogden School District—Roger Snow, SOAR into STEM Project Lead
- Weber School District—John Donley, CTE Coordinator Weber Innovation High School

Proposal—Weber State University will partner with Davis, Morgan, Weber, and Ogden School Districts; and the Northern Utah Academy for Math, Engineering, and Science (NUAMES) to provide a stackable credential pathway for the high need area of Software Development and Information Technology.

WSU's Computer Science program offers certificates; and associate, bachelor, and master's degrees, providing a number of entry and exit points for students with each successive step providing students access to an advanced degree and associated higher wages, as well as a skillset that allows for earlier access to available employment through internships, two of the goals of the Strategic Workforce Initiative.

WSU proposes to speed up the Computer Science career pathway beginning with secondary school students enrolled in Concurrent Enrollment by offering the four Computer Science courses needed for the first stackable credential: WSU Programming Essentials Certificate of Proficiency. Currently, high schools have a difficult time finding computer science instructors to teach these concurrent enrollment courses. Therefore, we propose having two university faculty teach courses at central locations as well as provide distance education to meet the needs for area schools/students not able to attend the centralized locations. The proposed central locations are

- WSU Farmington Station (serves South Davis District)
- WSU Davis Campus (serves North Davis District and NUAMES)
- Weber Innovation Campus (serves Weber District)
- WSU Ogden Campus (serves Ogden District)

The four university courses that allow students to obtain the Programming Essentials Certificate of Proficiency are

- CS 1030, Foundations of Computer Science
- CS 1400, Fundamentals of Programming
- CS 1410, Object-Oriented Programming
- CS 2420, Introduction to Data Structures and Algorithms

Thus, high school students could complete this 16-credit certificate from Weber State University while attending high school. Moreover, students will have 16 of the 40 major course credits required for the Computer Science Associate of Science degree. These students can be even further ahead if they take other general education concurrent enrollment courses such as English and mathematics.

Computer Science Student Data—Table 1 illustrates the Fall Semester 2016 enrollment for Computer Science concurrent enrollment courses in the area high schools as well as the 2015-16 student enrollment, attainment rates, and job placement rates for the AAS, BS, and MS degrees. The goal of this proposal is to connect with more high school Computer Science students and get them to complete the first Stackable Credential in this high need area while in high school.

Table 1 Computer Science Stackable Educational Credential Student Data

Computer Science Stackable Educational Credential Student Data			
	Student Enrollment Fall Semester 2016	Attainment Rates (2015-16 graduates)	Job Placement Rates
CS Programming Essentials Certificate of Proficiency (high school students only)	CS 1030 - 155 CS 1400 - 62 CS 1410 - 8 CS 2420 - 0	NA New proposal	NA
Computer Science Associate of Applied Science	459	46	90+ %
Computer Science Bachelor of Science	746	120	90+ %
Master of Science Degree Computer Engineering	4	New program – began January 2016	

Stackable Sequence of Credentials— To meet the growing demand for computer science professionals, students need to start early in Computer Technology Education classes in computer science or Information Technology in secondary schools. With stackable credentials started in high school and completed at Weber State University, these students can realistically become IT professionals or computer engineers who start their own companies, lead the Department of Defense in computer security or F-35 sustainment, or become tech industry leaders. As shown in the following stackable sequence, students enter during high school completing the WSU Programming Essentials Certificate of Proficiency as concurrent enrollment courses and can exit to internships leading to employment or additional educational levels. The following are the four educational stackable credentials:

1. Programming Essentials Certificate of Proficiency
2. Associate of Applied Science Degree in Computer Science
3. Bachelor of Science Degree in Computer Science
4. Master of Science in Computer Engineering.

The detailed courses for the Computer Science Stackable Credentials are shown in Figure 1.

Figure 1: Strategic Workforce Stackable Credentials

Computer Science Stackable Credentials

Step 1: WSU Programming Essentials Certificate of Proficiency (High School Concurrent Enrollment)

Step 1: High School (16 credits)	Credits
CS 1030 Foundations of Computer Science	4
CS 1400 Fundamentals of Programming	4
CS 1410 Object-Oriented Programming	4
CS 2420 Introduction to Data Structures and Algorithms	4
Total	16

Weber State University

Step 2: Associate of Science in Computer Science

Computer Science Courses Required (28 credit hours)	Credits	Support Courses Required (18-21 credit hours)	Credits
CS 2130 - Computational Structures	4	ENGL 2010 EN - Intermediate College Writing	3
CS 2350 - Web Development	4	PHYS 2210 PS - Physics for Scientists and Engineers I	5
CS 2450 - Software Engineering I	4	Communication	3
CS 2705 - Network Fundamentals and Design	4	MATH 1210 - Calculus I	4
CS 2550 - Introduction to Database Design and SQL	4	MATH 3410 - Probability and Statistics I	3
CS 2810 - Computer Architecture/Organization	4		
CS 2899 - Associate Degree Assessment	4		
Total	28	Total	18-21

Step 3: Bachelor of Science in Computer Science

Computer Science Courses Required (24 credit hours)	Credits
CS 3100 - Operating Systems	4
CS 3230 - Object Oriented User Interface Development with Java *OR*	4
CS 3280 - Object Oriented Windows Application Development	4
CS 3550 - Advanced Database Programming	4
CS 3750 - Software Engineering II	4
CS 4110 - Concepts of Formal Languages and Algorithms for Computing	4
CS 4790 - .NET Web Application Development *OR*	4
CS 4230 - Java Application Development *OR*	4
CS 4450 - Advanced Software Engineering Methods *OR*	4
CS 4350 - Advanced Internet Programming *OR*	4
CS 4650 - Advanced Game Development	4
CS 4899 - Bachelor's Degree Assessment	0
Total	24

Support Courses Required (10-12 credit hours)	Credits
ENGL 3100 - Professional and Technical Writing *OR*	3
NET 3250 - Business Communication *OR*	3
ENGL 2250 CA - Creative Writing *OR*	3
PHIL 1250 HU - Critical Thinking *OR*	3
MATH 1220 - Calculus II	4
PHYS 2300 - Scientific Computing for Physical Systems *OR*	3
MATH 2210 - Calculus III *OR*	4
MATH 2270 - Elementary Linear Algebra *OR*	3
MATH 3160 - Number Theory *OR*	3
PHYS 2220 - Physics for Scientists and Engineers II *OR*	5
MATH 3610 - Graph Theory	3
Total	10-12

CS Electives (8 credit hours)	
Choose 2 upper division computer science courses (see list of suggested electives). You may not use CS 4800 or CS 4850 or CS 4890 for these electives.	8

Other Electives (6 credit hours)	
Choose 6 credits of any approved upper division courses from CS, IS&T, NET, EET, PHYS, BSAD, AND MATH. This may include up to 4 credits maximum in any one of the following courses: CS 4800, CS 4850, or CS 4890. Choose 6 credits of any approved upper division courses from CS, IS&T, NET, EET, PHYS, BSAD, AND MATH. This may include up to 4 credits maximum in any one of the following courses: CS 4800, CS 4850, or CS 4890 (max 6 credits total).	6

Suggested Upper Division CS Electives

Recommended electives for students desiring to pursue a Master's Degree in Computer Science	Credits
CS 4280 - Computer Graphics	4
CS 4500 - Artificial Intelligence and Neural Networks	4
CS 4820 - Compiler Design	4

Step 4: Master of Science in Computer Engineering (MSCE)

Leveling Courses	Credits
ECE 3110 - Microelectronic I	4
ECE 3210 - Signals and Systems	4
ECE 3610 - Digital Systems	4
Total	12

Math (4 credit hours)	Credits
Math 2250 - Linear Algebra & Differential Equations OR	4
MATH 2270 - Elementary Linear Algebra AND	3
MATH 2280 - Ordinary Differential Equations	3
Total	4-6

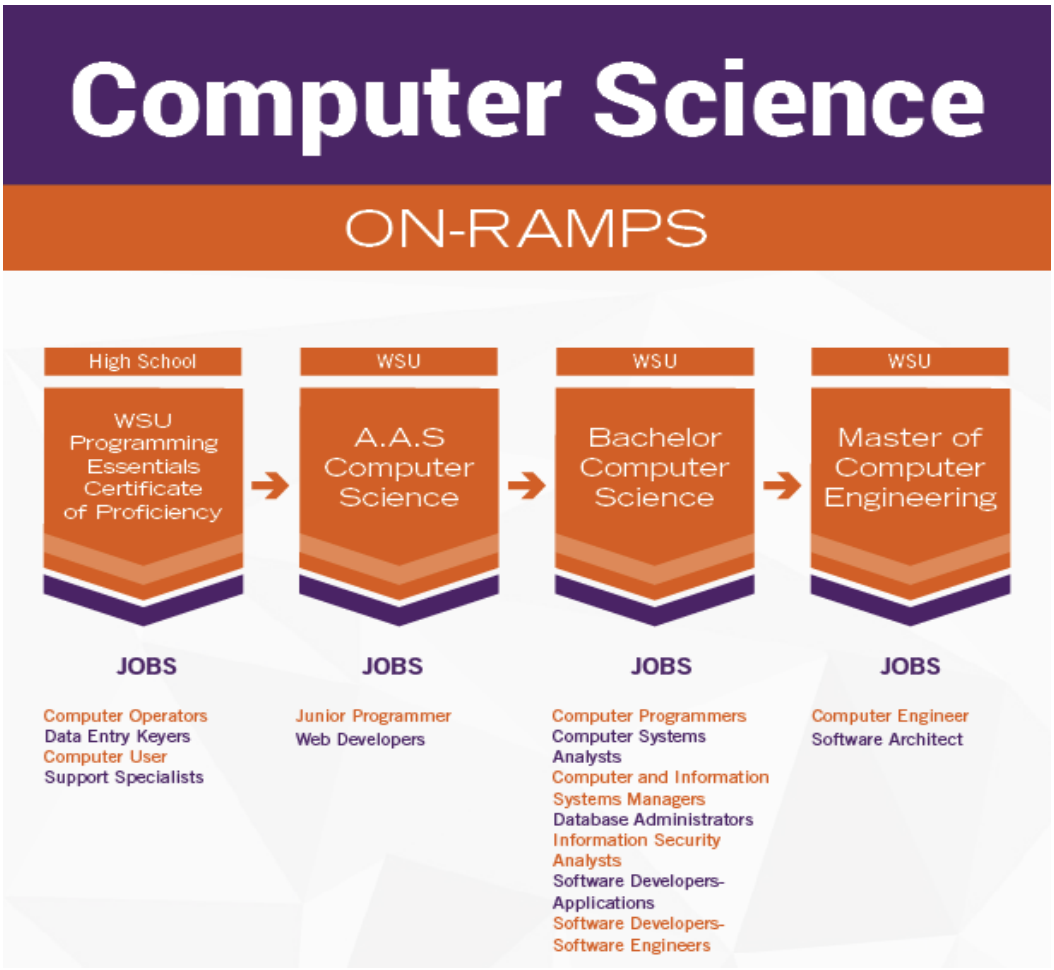
MCSE Required Courses (12 credit hours)	Credits
ECE 6110 - Digital VLSI Design	3
ECE 6210 - Digital Signal Processing	3
CS 6420 - Advanced Algorithms	3
CS 6610 - Computer Architecture	3

Design Project (6 credit hours)	Credits
ECE 6010 - Design Project	2-6

Elective Courses Required (4 courses required, 12-15 credit hours)	Credits
ECE 6120 - Advanced VLSI Design	3
ECE 6130 - Advanced Semiconductor Devices	3
ECE 6220 - Image Processing	3
ECE 6410 - Communication Circuits and Systems	3
ECE 6420 - Digital Communication	3
ECE 6710 - Real-Time Embedded Systems	4
CS 6100 - Distributed Operating Systems	3
CS 6500 - Artificial Intelligence and Neural Networks	4
CS 6600 - Machine Learning	3
CS 6820 - Compiler Design	4
CS 6840 - Formal System Design	3
CS 6850 - Parallel Programming and Architecture	3
Total	12-15

Figure 2 contains the employment opportunity path, strategic workforce on-ramps and off-ramps, for students.

Figure 2: Strategic Workforce On-Ramps and Off-Ramps



Evidence of Support from Industry Advisory Group/Local Industry--The WSU Computer Science Advisory Committee and local industry have affirmed support for this proposal by supporting jobs and internships early in a student's educational path. Support of the project is wide ranging, from relatively small, privately held organizations, to large international firms and aerospace industries.

Borsight Inc.—John Allen, Director of Engineering, stated that "Borsight Inc. (has worked and will continue to work closely) with the Weber State University (WSU) School of Computing and plans to hire 3-5 employees in software engineering in the next year. Currently, we have 8 number of employees in software engineering, 8 in system engineering, and 6 in cybersecurity."

HQ--HQ plans to hire 5 - 10 employees in software engineering in the next year. "Currently, we have 10 number of employees in software engineering, mobile, and web development." They also plan to work closely with the WSU School of Computing.

Hill Air Force Base—Norm LeClair, Chief, Workforce Development Branch, stated that "Software engineering is a tough one for us. We can hire in this series most easily if the title of the degree includes computer science somewhere within it (e.g. Computer Science, Software Engineering disciple, or any combination that you can dream up). This has to do with how AFPC interprets degrees. I can provide more insight into that at a later date. It also depends on the CIP code chosen for the degree. We have to have one that is on SAF/AQR's approved list. So, assuming all of that works, we can hire up to 50 students a year with the course content that arises from a CS disciplined approach to SW engineering."

Imagicom Corporation—Sean Stomberg stated that "Imagicom Corporation has worked with and will continue to work with the Weber State University School of Computing and plans to hire 3 employees in software engineering in the next year. Currently, we have 7 employees in software engineering."

InMoment—InMoment is an information-based industry located in Salt Lake City. Kurt Williams stated, "As for InMoment, we will absolutely continue to hire from Weber State University. Hiring quality CS graduates is incredibly difficult. The technology industry is in dire need of more programmers, architects, DBAs, and UX developers. WSU is a key provider of badly needed talent."

L-3—Randall Hughes, Manager, Systems & Software Quality Assurance, stated, "L-3 CS-West has a long and productive history of working with the Weber State University School of Computing. The university has an excellent track record of providing a pool of co-op talent from which I personally have hired several students. CS-West in Salt Lake City currently has 26 job postings in our various software/firmware areas. Currently, we have approximately 220 software engineers working in several disciplines including user interfaces, embedded computing and other high speed networked communication solutions."

LDS Church Family Search.org—Bruce Bolingbroke, Software Engineering Coach at FamilySearch, Greater Salt Lake City Area Information Technology and Services, stated, "I've been told not to share our employment plans or statistics with any outside entities. We do, however, hire interns and employees from WSU each year and appreciate their readiness to enter the workforce in computer science."

Marketstar—Christopher Wall stated, "Marketstar has worked with Weber State for many years and recently has committed to Weber State to increase our support of the school through mentorship and networking opportunities, internships and direct hiring and placement efforts. Marketstar has specifically focused efforts on the students of the Computer Sciences program. We have found that Weber produces some very quality potential employees."

Since the start of the Marketstar Launch program in the Fall of 2016, "we have placed 9 students in permanent CS career positions within our organization. Marketstar has committed to continue to source our Entry Level development and software technology employees, whenever possible, from Weber State." Here are a couple of comments from managers at Marketstar about the quality of WSU students:

"The external candidates I've interviewed thus far have just been OK. Some of them have had applicable experience but not the drive and personality like the interns we have now. The skills our interns are bringing to the table are often times more applicable and all-encompassing than those who have previous experience with another company." **-- Trevor Thompson, Sr. Manager - BI**

"We've had to make some changes in the department based on voluntary attrition, and some involuntary attrition. The interns we have had in, have been tremendous in doing what we need them to do, but also bringing new ideas." **-- Phil Mickey, Sr. Manager - Marketing**

U.S. Department of the Treasury—The U.S. Department of the Treasury has a distinguished history dating back to the founding of our nation. As the steward of U.S. economic and financial systems, Treasury is a major and influential leader in today's global economy. They have over 100,000 employees across the country and around the world. The IRS Recent Graduates Program affords developmental experiences in the Federal Government intended to promote possible careers in the civil service to individuals who have recently graduated from qualifying educational institutions or programs. Selectees are placed in a dynamic, developmental program with the potential to lead to a civil service career in the Federal Government. Following the successful completion of program requirements, applicants may be considered for non-competitive conversion to a career-conditional or term appointment.

According to Mike Halverson, Chief, Compliance Development Branch, Compliance Domain, The Internal Revenue Service, has a significant presence in the Ogden area. The IRS would like to hire 10 or more individuals who meet the following criteria in the greater Ogden area.

"Program requirements include but are not limited to successful completion of at least 1-year of continuous service; completion of at least 40 hours of interactive training; demonstration of successful job performance; and meet the qualification standards for the position to which the Recent Graduate may be converted. If selected, applicants will be placed in a position as an Information Technology Specialist, GS-2210, Career Ladder 5/7/9/11/12 in the IT Division. Open to U.S. Citizens who are Recent Graduates and have completed a degree or certificate from a qualifying education institution within the previous 2 yrs. Students who are within 9 months of graduating may apply. The pay range is $32,318.00 to $69,460.00 / Per Year. "

Woodbury Technologies—Karen Woodbury, CEO and President of WT, Inc., stated, "Woodbury Technologies plans to continue working with the Weber State University School of Computing in 2017. We will hire approximately ten employees next year in software positions. Currently, we have 96 employees in software engineering, systems managers, database administrators, information security administrators, and network engineers."

Board of Regents Support—The Board of Regents will send a separate message of support.

Computer Science Workforce Needs—Table 2 illustrates the number of Utah job openings and wages for job titles at the various levels of education.

Table 2 Employment Information (Source: DWS)

Utah Computer Science Employment Needs and Wages					
Stackable Educational Level	**Job Title**	***Projected Annual Statewide Job Openings (2014-2024)***			**Median Wage Per Hour**
		Current Employment	**Projected Employment**	**Total Annual Openings**	
Programming Essentials ***Certificate of Proficiency***	Data Entry Keyers	4,133	4,701	110	14.69
	Computer Operators	334	310	--	19.65
	Computer User Support Specialist	7,799	11,246	450	20.39
Computer Science ***Associate of Applied Science***	Junior Programmer	DWS data not available – this position leads to computer programmer position			
	Web Developer	2,120	3,291	140	26.88
Computer Science ***Bachelor of Science***	Computer Systems Analysts	3,820	5,712	240	33.95
	Information Security Analysts	354	489	20	35.89
	Computer Programmers	3,695	4,478	170	37.28
	Database Administrators	920	1,270	50	39.67
	Software Developers-Applications	8,844	14,036	640	43.96
	Software Developers-Systems Software	3,052	4,356	170	44.63
	Computer and Information Systems Managers	3,081	4,470	170	56.31
***Master of Science* in Computer Engineering**	Computer Engineer	*DWS Data not available		421	Salary: $108,430 (50th percentile)*
	Software Engineer			809	Salary: $91,910 (50th percentile)*
*DWS data not available – annual salary data obtained from http://www.learnhowtobecome.org/computer-programmer/					

Funding Request Items—The budget requested to support this proposal is listed in Table 3.

Table 3 Budget

Weber State University	
Funding Need—One-time money	**Budget**
Distance Learning Lab Create an Interactive Video Conferencing (IVC) room to initiate and facilitate distance learning from WSU. The room includes instructor station, classroom microphones, cameras, and computers. Can facilitate up to 15 distance locations. Can broadcast live or recorded.	$38,000
Funding Need—Ongoing	
Faculty Position A faculty position to bridge the gap of lack of qualified computer science teachers in the Secondary Schools. This person would a. Teach CS 1030 and CS 1400 at secondary school magnet locations either in a face-to-face or remote format. **b.** Facilitate the training for CS concurrent high school instructors to be ready to teach CS 1030 and CS 1400 at schools where teachers are available. c. Teach a minimum of half time (four classes) at the university to offset the increased demand at the university level. d. Advise secondary students in pursuing additional educational step (AAS Degree) and employment opportunities.	$110,000
Faculty Position A faculty position to bridge the gap of lack of qualified computer science teachers in the Secondary Schools. This person would a. Teach CS 1410 and CS 2420 at secondary school magnet locations either in a face-to-face or remote format. b. Coordinate/develop internships and jobs with industry partners. c. Coordinate the Bridge the Gap training for students to be ready for internships/jobs their freshman year of college.	$110,000
Student Training—Since employers use a broad range of technologies including over 200 software programs and multiple platforms, companies like the Farmington, Utah, based Pluralsight provide individualized training that gives students the opportunity to obtain software, platform, and technology skills that are unique to employers. This money covers the cost of students' access to training.	$15,000
Secondary Schools	
Davis School District	
Equipment/Software: Each student needs laptop (video) or pc with webcam, mic headset (approximate cost - $800 each)—allows for Econo connect if not in IVC room. *High School Facilitators and Support Staff:* $1,800 per course, approximately 60 hours, includes reporting, follow up, mentoring, academic intervention, assisting with IVC connections. *Training:* Current high school teachers will receive training in order to teach Computer Science concurrent enrollment courses in traditional high school classroom sections. As demand increases, this training provides more teachers for this high need area.	$10,000

Morgan School District	
Equipment/Software: Each student needs laptop (video) or pc with webcam, mic headset (approximate cost - $800 each)—allows for Econo connect if not in IVC room. *High School Facilitators and Support Staff:* $1,800 per course, approximately 60 hours, includes reporting, follow up, mentoring, academic intervention, assisting with IVC connections. *Training:* Current high school teachers will receive training in order to teach Computer Science concurrent enrollment courses in traditional high school classroom sections. As demand increases, this training provides more teachers for this high need area.	$10,000
NUAMES	
Equipment/Software: Each student needs laptop (video) or pc with webcam, mic headset (approximate cost - $800 each)—allows for Econo connect if not in IVC room. *High School Facilitators and Support Staff:* $1,800 per course, approximately 60 hours, includes reporting, follow up, mentoring, academic intervention, assisting with IVC connections. *Training:* Current high school teachers will receive training in order to teach Computer Science concurrent enrollment courses in traditional high school classroom sections. As demand increases, this training provides more teachers for this high need area.	$10,000
Ogden School District	
Equipment/Software: Each student needs laptop (video) or pc with webcam, mic headset (approximate cost - $800 each)—allows for Econo connect if not in IVC room. *High School Facilitators and Support Staff:* $1,800 per course, approximately 60 hours, includes reporting, follow up, mentoring, academic intervention, assisting with IVC connections. *Training:* Current high school teachers will receive training in order to teach Computer Science concurrent enrollment courses in traditional high school classroom sections. As demand increases, this training provides more teachers for this high need area.	$10,000
Weber School District	
Equipment/Software: Each student needs laptop (video) or pc with webcam, mic headset (approximate cost - $800 each)—allows for Econo connect if not in IVC room. *High School Facilitators and Support Staff:* $1,800 per course, approximately 60 hours, includes reporting, follow up, mentoring, academic intervention, assisting with IVC connections. *Training:* Current high school teachers will receive training in order to teach Computer Science concurrent enrollment courses in traditional high school classroom sections. As demand increases, this training provides more teachers for this high need area.	$10,000
Total On-Going Funding Weber State University and Secondary Schools	$285,000