

Course Title: Introduction to Metal Fabrication

Unit 1:	Career Opportunities
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Content Standard(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> 1. Identify careers available in metal fabrication. 2. Describe the history of metal fabrication and its impact on the industry. Examples: history – blacksmithing, oxyfuel development, arc welding, metal inert gas (MIG) welding, tungsten inert gas (TIG) welding impact – automated systems making jobs obsolete, reduction in number of workers in job market
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Learning Objective(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> 1. Identify career opportunities in the metal fabrication field. (national, state, local) 2. Discuss educational requirements for career in metal fabrication. 3. Discuss working conditions. 4. Compare benefits in the metal fabrication field for workers. 5. Fill out application for employment. 6. Write résumé. 7. Discuss the history of welding. 8. Define welding terminology. 9. Research the history of welding. 10. Discuss automated welding systems and the impact on jobs.
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Essential Question(s):	What are the benefits and requirements of a career in metal fabrication?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
I. Identify careers in metal fabrication.	Lecture	Microsoft PowerPoint
II. Research career opportunities.	PowerPoint Presentation	Websites
III. Working conditions	Note taking	Textbook
IV. Training for welding careers	Research	Computer
V. Fill out application for employment.	Worksheets	Internet
VI. Write resume.	Guest speaker	LCD Projector
VII. Determine wages for welding careers.	Portfolio	

VIII. Worker benefits associated with metal fabrication careers. IX. Working conditions in the field.	Fieldtrip Guest speaker Lecture PowerPoint Presentation Video	
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Unit Assessment:	Participation in discussion, Research Report, Written Test, Performance Task
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Unit/Course CTSO Activity:	Students can develop SAE program. Host a career fair for seniors.
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Unit/Course Culminating Product:	Students develop a career portfolio.
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Course/Program Credential(s): <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input checked="" type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:
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Unit 2:	Safety
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Content Standard(s) and Depth of Knowledge Level(s):	Students will: 3. Demonstrate safety procedures used in the metal fabrication industry.
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Learning Objective(s) and Depth of Knowledge Level(s):	Students will: 1. Explain the meaning of safety. 2. Identify high hazard areas. 3. Explain and demonstrate the use of appropriate personal protective equipment. 4. Demonstrate and explain general hand- and power-tool safety. 5. Recall general shop rules to be followed while in the shop. 6. Explain shop safety color-coding system. 7. Demonstrate knowledge of fire prevention and control methods. 8. Explain and demonstrate proper handling and storing of cylinders. 9. Identify proper lens shade to be used in Oxyfuel, Plasma, and SMAW.
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Essential Question(s):	What are the legal and social reasons for learning to prevent shop accidents?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
I. Meaning/Importance of shop safety II. High hazard areas III. PPE IV. Hand and Power Tool Safety V. Shop Rules VI. Safety Colors VII. Fire Safety VIII. Respiratory Protection IX. Ventilation Requirements X. Handling and Storing Cylinders XII. Proper Lens Shade	Lecture/demonstration Worksheets Laboratory/shop safety tour Hazard identification tour Safe tool operation demonstration Pretest/Posttest Guest speaker	PowerPoint LCD Projector Textbooks Quizzes Web sites Handouts Hand and power tools Videos MSDS PPE Safety Posters

Unit Assessment:	Participation in class discussion, participation in shop hazard identification, and shop safety test (100% mastery)
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Unit/Course CTSO Activity:	Incorporate safety practices into student's SAE project.
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Unit/Course Culminating Product:	Students will master shop safety by identifying mock safety hazards in the shop and by passing the safety portion of the lesson with a 100 on the shop safety test.
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Course/Program Credential(s): <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input checked="" type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:
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Unit 3:	Identification and Selection
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Content Standard(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <p>4. Explain the use of metal fabrication tools and equipment. Examples: tools – hacksaw, cold chisel, file, drill, chipping hammer, metal vise, grinder, striker, tip cleaner, wire brush, tongs equipment – welding helmet, fuel valves, oxyfuel torches</p> <p>5. Differentiate among types of metal used in metal fabrication. Examples: iron, aluminum, steel, tin, titanium, copper, magnesium, chromium, zinc</p>
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Learning Objective(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> 1. Identify tools used metal fabrication. 2. Demonstrate proper use of hand tools. 3. Identify welding equipment. 4. Explain the difference in welding with each of the three types of current. 5. Identify and explain the terms associated with metals. 6. Describe how metal is classified. 7. Describe the characteristics used to identify metals. 8. Identify type of metal used in metal fabrications
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Essential Question(s):	What affect does mining mineral have on the environment?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
<p>I. Metal fabrication tools and equipment</p> <p>A. Tools</p> <ol style="list-style-type: none"> 1. Hacksaw 2. Cold chisel 3. File 4. Drill 5. Chipping hammer 6. Metal vise grip 7. Grinder 8. Striker 	<p>Lecture Demonstration Textbook Worksheet Flashcards Teacher demonstration Student demonstrations Lecture Worksheet PowerPoint Presentation</p>	<p>Computer Internet Projector Hand tools Textbook Various tools used in metal fabrication PPE Metal for student to use in demonstrations Computer LCD Projector</p>

<ul style="list-style-type: none"> 9. Tip cleaner 10. Wire brush 11. Tongs B. Proper use of metal fabrication tools. C. Equipment <ul style="list-style-type: none"> 1. Welder 2. Plasma cutter 3. Oxyfuel torch D. Types of current <ul style="list-style-type: none"> 1. AC 2. DC <ul style="list-style-type: none"> a. Straight polarity b. Reverse polarity E. Metal by classification F. Metal characteristics <ul style="list-style-type: none"> 1. Ferrous 2. Nonferrous G. Types of metal used in fabrication 	<ul style="list-style-type: none"> Demonstration PowerPoint Presentation Lecture Worksheet Lead Question 	<ul style="list-style-type: none"> Welder Welding helmet Oxyfuel equipment Computer Projector
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Unit Assessment:	Written test, Class participation, Quiz
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Unit/Course CTSO Activity:	Prepare students for Agricultural Mechanics contest.
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Unit/Course Culminating Product:	Students will use knowledge learned to select metal used to construct projects.
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Course/Program Credential(s): <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input checked="" type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:
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Unit 4:	Metal Preparation and Finishing
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Content Standard(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> Demonstrate techniques for preparing metal for fabrication. Example: stripping, cleaning, grinding, buffing
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Learning Objective(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> Prepare unpainted metal for painting. Remove rust and scale from metal surfaces. Use various methods to prepare surfaces for fabrication.
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Essential Question(s):	What is the benefit of preparing metal surfaces before welding?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
VI. Preparing metal for fabrication <ol style="list-style-type: none"> Prepare unpainted metal for painting. Remove rust and scale from metal surfaces. Methods to prepare metal surfaces <ol style="list-style-type: none"> Steam cleaning Sanding (wire brush or emery cloth) Chemical cleaning Sandblasting 	Discussion Lecture with PowerPoint Lab Demonstration Discussion Lab Demonstration Lecture	Textbook Computer LCD projector Metal Hand tool Portable power tools

Unit Assessment:	Written test, project, class participation
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Unit/Course CTSO Activity:	Agricultural Mechanics CDE
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Unit/Course Culminating Product:	Students will prepare metal for fabrication in various ways.
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Course/Program Credential(s): <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input checked="" type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:
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Unit 5:	Metal Cutting
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Content Standard(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> 7. Prepare an oxyfuel unit for operation. <ul style="list-style-type: none"> • Explaining color- coding of oxyfuel tanks and hoses Examples: green for oxygen, orange or black for acetylene • Comparing shaded lenses used in oxyfuel welding and cutting • Checking for cracks and leaks in oxyfuel hoses and regulators 8. Use an oxyfuel torch, including adjusting the flame to neutral and cutting and fusing metal. 9. Demonstrate procedures for using plasma arc cutting equipment. <ul style="list-style-type: none"> • Describing the plasma arc cutting process • Identifying components of plasma arc cutting equipment • Cutting metal with plasma arc cutter
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Learning Objective(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> 1. Discuss proper shade of eye protection for oxyfuel torches. (welding helmet, glasses, goggles) 2. Identify parts of the oxyfuel torches. 3. Change oxygen and acetylene cylinders. 4. Check for leaks in gas equipment. 5. Adjust oxyacetylene valve controls. 6. Light and adjust oxyacetylene torches. 7. Shut off and bleed oxyacetylene equipment
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Essential Question(s):	How do students safely cut metal for fabrication?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
I. Proper eye protection for oxyfuel torches II. Parts of oxyfuel torch III. Change oxygen and fuel cylinders IV. Check leaks gas equipment V. Adjust valves controls VI. Adjust oxyacetylene torch VII. Bleed oxyacetylene torch	Lecture Student demonstration PowerPoint presentation Teacher demonstration	Welding helmet Welding glasses Welding goggles Oxyfuel torch PPE Textbook Oxyfuel torch

		Hand tools Oxyfuel torch PPE Hand tools Oxyfuel torch PPE Hand tools Oxyacetylene torch ¼ inch plate metal Oxyacetylene torch
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Unit Assessment:	Student performance, Student participation, Test
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Unit/Course CTSO Activity:	FFA Agricultural Mechanics CDE
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Unit/Course Culminating Product:	Students will safely operate an oxyfuel torch and plasma cutter.
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Course/Program Credential(s): <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input checked="" type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:
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Unit 6:	Welding Quality
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Content Standard(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> 10. Analyze weld imperfections to determine corrective measures. 11. Compare destructive and non-destructive weld testing methods.
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Learning Objective(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> 1. Inspect welds to determine flaws. 2. Determine corrective measure to correct flaws. 3. Explain the difference between destructive and non-destructive testing methods. 4. Describe non-destructive test methods. 5. Describe destructive test methods.
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Essential Question(s):	How are welds tested in the welding industry?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
<ol style="list-style-type: none"> I. Welding flaws <ol style="list-style-type: none"> A. Poor weld proportions B. Undercutting C. Lack of penetration D. Surface flaws and defects <ol style="list-style-type: none"> 1. Corrective measures 2. Amperage adjustment 3. Arc length 4. Speed of travel 5. Weave patterns II. Non-destructive test <ol style="list-style-type: none"> A. Visual inspection B. Magnetic particle inspection C. Liquid penetrate inspection D. Ultrasonic testing 	<p>Lecture PowerPoint presentation Demonstration Discussion</p>	<p>Textbook PowerPoint Computer LCD projector Practice metal Welding machine</p>

<ul style="list-style-type: none"> E. X-ray inspection F. Eddy current G. Mass spectrometer detection H. Air pressure leak I. Halogen gas leak <p>III. Destructive test</p> <ul style="list-style-type: none"> A. Bend B. Tensile C. Impact D. Hardness E. Microscopic F. Macroscopic G. Chemical analysis H. Fatigue I. Hydrostatic J. Peel test K. Tensile shear 		
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Unit Assessment:	Written test, quizzes, participation in discussion, project
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Unit/Course CTSO Activity:	Prepare students for Agricultural Mechanics CDE.
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Unit/Course Culminating Product:	Students will analyze and test welds to improve weld quality.
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Course/Program Credential(s): <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input checked="" type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:
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Unit 7:	Shielded Metal Arc Welding
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Content Standard(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <p>12. Explain the SMAW process.</p> <ul style="list-style-type: none"> • Comparing various types of welding electrodes used in SMAW Examples: E6010, E6013, E7014 <p>13. Demonstrate procedures for adjusting and operating the SMAW machine.</p> <ul style="list-style-type: none"> • Identifying various types of welding joints Examples: butt, lap, corner, T • Contrasting methods of striking an arc Examples: scratching, tapping, weaving • Identifying types of welds Examples: stringer, overlap, fillet • Demonstrating techniques for flat, vertical, horizontal, and overhead welding
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Learning Objective(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> 1. Compare different types of welding electrodes. 2. Recognize color and numerical code marking on electrodes. 3. Identify welding machines according to type. 4. Identify types of welding joints. 5. Discuss methods of striking an arc. 6. Identify types of welds. 7. Demonstrate ability to weld flat, vertical, horizontal, and overhead welding. 8. Create a butt, lap, T, and corner joints.
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Essential Question(s):	What benefits does a career in the welding field provide?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
I. Proper electrode selection A. Tensile strength B. Base metal composition C. Position of weld joint D. Type of arc welding current used E. Penetration required	Lecture Demonstration PowerPoint Project based learning activity Lecture Demonstration	Textbook Computer Welding machine Metal for project Welding supply

<ul style="list-style-type: none"> F. Metal thickness II. Electrode marking systems <ul style="list-style-type: none"> A. Arc power source classification B. AC C. DC D. Combination ac/dc III. Welding joints <ul style="list-style-type: none"> A. lap B. butt C. corner IV. Striking an arc <ul style="list-style-type: none"> A. tap B. Strike V. Types of weld <ul style="list-style-type: none"> A. flat B. vertical C. horizontal D. overhead 	<ul style="list-style-type: none"> Textbook Worksheet Teacher Demonstration Student demonstrations Power point Demonstration Student practice Group assignment Guest speaker Individual assignment 	
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Unit Assessment:	Project, Written Test, Participation
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Unit/Course CTSO Activity:	Build enhance Supervised Agricultural Experience.
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Unit/Course Culminating Product:	Plan and build a FFA display.
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Course/Program Credential(s): <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input checked="" type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:
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Unit 8:	Metal Assembly
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Content Standard(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> 14. Cut threads in metal using a tap. 15. Cut metal threads using a die. 16. Explain the process of laying out and cutting sheet metal. 17. Demonstrate the use of rivets in sheet metal assembly.
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Learning Objective(s) and Depth of Knowledge Level(s):	<p>Students will:</p> <ol style="list-style-type: none"> 1. Tap threads in holes. 2. Cut threads on bolts and pipe. 3. Drill holes in metal. 4. Mark metal. 5. Cut and file metal. 6. Bend square, round, and flat steel. 7. Fasten metal with rivets.
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Essential Question(s):	What are the ways that metal can be manipulated for assembly?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
<ol style="list-style-type: none"> I. Equipment used to perform tap and die cutting procedures II. Procedure for cutting internal threads III. Procedure for cutting rod or pipe IV. Procedure for drilling holes in metal V. Lay out mark metal for project VI. Cut and file metal VII. Procedure for bending square, round, and flat steel VIII. Procedure for fasten metal with rivets 	<p>Power point Lecture Worksheet Project-based Learning Activity Laboratory/shop</p>	<p>Textbooks Rubrics Handouts Pipe, rod, flat steel Tap and die Drill Drill bit set Soap stone Scratch all Pop riveter</p>

Unit Assessment:	Quizzes, performance task, demonstration project
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Unit/Course CTSO Activity:	Students design and build a display for the FFA chapter.
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Unit/Course Culminating Product:	Complete a small project utilizing the methods of assembly described in lesson.
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Course/Program Credential(s): <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input checked="" type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:
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