Complete Aseprite Tutorial Curriculum: Detailed Session Guide

TIER 1: FOUNDATION MASTERY (12-15 Hours)

Module 1: Aseprite Fundamentals & Photoshop Transition (3 Hours)

Session 1.1: Interface Mastery & Initial Setup (1 Hour)

Learning Objectives:

- Navigate Aseprite's interface with confidence
- Configure workspace for optimal pixel art creation
- Understand fundamental differences from Photoshop workflows

Content Breakdown:

- Welcome & Course Overview (5 min)
- Aseprite Interface Tour: Timeline, layers, color bar, tool panel (15 min)
- Workspace Customization: Docking panels, saving layouts, UI scaling (10 min)
- Essential Preferences Setup: Grid, pixel ratio, background color (10 min)
- Photoshop Comparison: Key workflow differences and advantages (10 min)
- Hands-on Practice: Create first pixel canvas and basic shapes (10 min)

Deliverable: Configured workspace screenshot and first 32×32 pixel art creation

Session 1.2: Core Tools Deep Dive (1 Hour)

Learning Objectives:

- Master essential pixel art tools
- Understand tool properties and modifiers
- Learn precision drawing techniques

Content Breakdown:

- Pencil Tool Mastery: Pixel-perfect lines, shift modifiers, contiguous mode (10 min)
- Selection Tools: Rectangular, magic wand, lasso with pixel precision (10 min)
- Transform Tools: Move, rotate, flip with pixel alignment (10 min)
- Color Tools: Eyedropper shortcuts, palette management, shading ramps (10 min)
- Shape Tools: Rectangles, circles, lines with pixel-perfect settings (10 min)
- Practice Exercise: Recreate classic game sprites using learned tools (10 min)

Deliverable: Tool practice sheet with 10 mini exercises completed

Session 1.3: Layer System & Color Management (1 Hour)

Learning Objectives:

- Master Aseprite's layer system
- Understand indexed vs RGB color modes
- Create and manage color palettes

Content Breakdown:

- Layer Types: Normal, background, tilemap layers explained (10 min)
- Blend Modes & Opacity: Practical applications for pixel art (10 min)
- Color Mode Deep Dive: RGB vs Indexed, when to use each (10 min)
- Palette Creation: Building cohesive color schemes, importing palettes (15 min)
- Color Ramps: Creating smooth gradients with limited colors (10 min)
- Practice: Create a simple scene using multiple layers and custom palette (5 min)

Deliverable: Layered artwork file with custom 16-color palette

Module 2: Tablet Optimization & Precision Workflows (2 Hours)

Session 2.1: Deco 01 V3 Complete Setup (1 Hour)

Learning Objectives:

- Configure tablet for pixel-perfect precision
- Optimize pressure settings for pixel art
- Create efficient button mappings

Content Breakdown:

- Driver Installation & Updates: Latest XPPen software setup (10 min)
- Pressure Curve Configuration: Disabling or customizing for pixel art (10 min)
- Active Area Mapping: Full tablet vs precision zones (10 min)
- Express Key Programming: Tool shortcuts and modifiers (10 min)
- Pen Button Configuration: Right-click and modifier keys (10 min)
- Testing & Calibration: Ensuring 1:1 pixel accuracy (10 min)

Deliverable: Exported tablet configuration file and test artwork

Session 2.2: Advanced Precision Techniques (1 Hour)

Learning Objectives:

- Master pixel-perfect line drawing
- Learn sub-pixel prevention techniques
- Develop muscle memory for common actions

Content Breakdown:

- Line Drawing Techniques: Straight lines, curves, angles (15 min)
- Pixel Perfect Shapes: Circles, ellipses without artifacts (10 min)
- Anti-aliasing Prevention: Settings and techniques (10 min)
- Zoom Level Strategies: When to work at different magnifications (10 min)
- Grid & Snap Settings: Using guides effectively (10 min)
- Speed Building Exercise: Timed precision challenges (5 min)

Deliverable: Precision technique practice sheet with all exercises

Module 3: Platform Constraints & Technical Requirements (3 Hours)

Session 3.1: GBStudio Requirements Deep Dive (1 Hour)

Learning Objectives:

- Understand Game Boy hardware limitations
- Master 4-color palette restrictions
- Learn sprite size and memory constraints

Content Breakdown:

- Game Boy Hardware Overview: Technical capabilities explained (10 min)
- Color Palette System: DMG vs GBC, working with 4 colors (15 min)
- Sprite Specifications: Size limits, tile arrangements, memory (15 min)
- Background Requirements: Tile limits, scrolling considerations (10 min)
- Asset Organization: Folder structure for GBStudio projects (5 min)
- Practice: Convert existing sprite to GBStudio specifications (5 min)

Deliverable: GBStudio-ready sprite sheet with proper constraints

Session 3.2: NES/NESmaker Technical Mastery (1 Hour)

Learning Objectives:

- Understand NES graphical architecture

- Master CHR ROM limitations
- Learn palette management strategies

Content Breakdown:

- NES Architecture: PPU, pattern tables, nametables explained (10 min)
- CHR Organization: 8×8 tile system, bank switching (15 min)
- Palette System: 4 background + 4 sprite palettes detailed (15 min)
- Sprite Limitations: 8 sprites per scanline, flickering solutions (10 min)
- Attribute Tables: Color assignment for backgrounds (5 min)
- Practice: Create NES-compatible tileset (5 min)

Deliverable: NES-formatted CHR tiles with proper palette usage

Session 3.3: Godot Pixel Art Configuration (1 Hour)

Learning Objectives:

- Configure Godot for pixel-perfect rendering
- Understand scaling and filtering options
- Learn import settings optimization

Content Breakdown:

- Project Settings: Resolution, scaling, pixel snap configuration (15 min)
- Import Settings: Filter modes, compression, mipmaps (10 min)
- Viewport Configuration: Integer scaling strategies (10 min)
- Camera Setup: Pixel-perfect movement and scrolling (10 min)
- Animation Integration: Sprite sheets vs individual frames (10 min)
- Testing: Multi-resolution compatibility checks (5 min)

Deliverable: Godot project template with optimal pixel art settings

Module 4: AI Integration Setup & Workflows (4 Hours)

Session 4.1: RetroDiffusion Installation & Setup (1 Hour)

Learning Objectives:

- Install and configure RetroDiffusion
- Understand model selection and parameters
- Learn basic prompt engineering

Content Breakdown:

- System Requirements Check: GPU, Python, dependencies (10 min)
- Installation Process: Step-by-step setup guide (15 min)
- Model Overview: Different models for different styles (10 min)
- Interface Navigation: Controls and parameters explained (10 min)
- Basic Generation: First AI sprite creation (10 min)
- Troubleshooting: Common issues and solutions (5 min)

Deliverable: Successfully generated first AI pixel art asset

Session 4.2: Advanced Prompt Engineering (1 Hour)

Learning Objectives:

- Master prompt structure for pixel art
- Learn style modifiers and negative prompts
- Understand seed control and variations

Content Breakdown:

- Prompt Anatomy: Subject, style, technical specifications (15 min)
- Style Modifiers: Game genres, era specifications, artist styles (10 min)
- Negative Prompts: Preventing common AI artifacts (10 min)
- Seed Management: Controlling variations and iterations (10 min)
- Batch Processing: Generating multiple variations efficiently (10 min)
- Practice: Generate character concept variations (5 min)

Deliverable: Collection of 10 AI-generated concept sprites

Session 4.3: AI to Manual Refinement Pipeline (1 Hour)

Learning Objectives:

- Establish efficient AI-to-pixel-art workflow
- Learn cleanup and refinement techniques
- Understand when to use AI vs manual creation

Content Breakdown:

- Import & Scale: Bringing AI assets into Aseprite (10 min)
- Cleanup Techniques: Removing artifacts, fixing edges (15 min)

- Color Reduction: Converting to limited palettes (10 min)
- Detail Enhancement: Adding pixel-perfect details (15 min)
- Style Consistency: Maintaining cohesive look across assets (5 min)
- Workflow Optimization: Time-saving strategies (5 min)

Deliverable: Before/after comparison of refined AI sprite

Session 4.4: Alternative AI Tools & Cloud Solutions (1 Hour)

Learning Objectives:

- Explore PixelLab and other alternatives
- Understand cloud vs local processing
- Learn tool selection criteria

Content Breakdown:

- PixelLab Setup: Account creation and credits system (10 min)
- Feature Comparison: RetroDiffusion vs PixelLab vs others (15 min)
- Cloud Workflow: Browser-based generation strategies (10 min)
- Animation Tools: AI-assisted animation features (10 min)
- Integration Methods: Combining multiple AI tools (10 min)
- Cost Analysis: Budgeting for AI assistance (5 min)

Deliverable: Comparison chart of AI tools with sample outputs

TIER 2: PRODUCTION PROJECTS (20-25 Hours)

Module 5: Character Sprite Creation (8 Hours)

Session 5.1: Character Design Fundamentals (1.5 Hours)

Learning Objectives:

- Establish character proportions for pixel art
- Create readable silhouettes at small sizes
- Develop consistent style guide

Content Breakdown:

- Proportion Systems: 1:1, 1:2, 1:3 head-to-body ratios (20 min)
- Silhouette Design: Testing readability at target resolution (15 min)
- Character Sheet Creation: Turnarounds and detail views (20 min)

- Style Consistency: Defining line weights and detail levels (15 min)
- Personality Through Pixels: Conveying character traits (10 min)
- Reference Gathering: Building mood boards and inspiration (10 min)

Deliverable: Complete character design sheet with annotations

Session 5.2: Base Sprite Construction (1.5 Hours)

Learning Objectives:

- Build character sprite from scratch
- Apply platform-specific constraints
- Create modular sprite components

Content Breakdown:

- Foundation Sketch: Rough pixel blocking (15 min)
- Line Art Creation: Clean pixel-perfect outlines (20 min)
- Basic Coloring: Flat colors and organization (15 min)
- Shading Techniques: Light source and volume (20 min)
- Detail Pass: Eyes, clothing, accessories (15 min)
- Platform Variants: GBStudio, NES, Godot versions (5 min)

Deliverable: Complete static character sprite in three platform variants

Session 5.3: Idle Animation (1.5 Hours)

Learning Objectives:

- Create believable idle animation
- Master subtle movement principles
- Learn efficient frame management

Content Breakdown:

- Animation Planning: Timing charts and key poses (15 min)
- Breathing Cycle: Natural respiratory movement (20 min)
- Secondary Motion: Hair, clothing, accessories (20 min)
- Micro-movements: Blinking, looking around (15 min)
- Frame Optimization: Minimum frames for smooth motion (10 min)
- Loop Testing: Seamless animation cycles (10 min)

Deliverable: 4-6 frame idle animation loop

Session 5.4: Walk Cycle Mastery (2 Hours)

Learning Objectives:

- Create professional walk cycle
- Understand weight and balance
- Master foot placement and timing

Content Breakdown:

- Walk Cycle Theory: Contact, down, passing, up positions (20 min)
- Key Frame Creation: 4 main positions (25 min)
- In-between Frames: Smooth transitions (25 min)
- Arm Movement: Opposing motion and flow (15 min)
- Secondary Animation: Hair, clothing bounce (15 min)
- Speed Variations: Walk vs power walk adjustments (10 min)
- Platform Testing: Checking all target platforms (10 min)

Deliverable: 8-frame walk cycle animation

Session 5.5: Run & Jump Animations (1.5 Hours)

Learning Objectives:

- Design dynamic movement animations
- Master motion blur techniques
- Create impactful action sequences

Content Breakdown:

- Run Cycle Creation: Faster timing, lean forward (25 min)
- Jump Sequence: Anticipation, launch, apex, landing (25 min)
- Motion Techniques: Smears and motion lines (15 min)
- Impact Frames: Emphasizing key moments (10 min)
- Transition Frames: Connecting different states (10 min)
- State Machine Planning: Animation connections (5 min)

Deliverable: Run cycle and complete jump sequence

Module 6: Environmental Tileset Development (6 Hours)

Session 6.1: Tileset Architecture & Planning (1.5 Hours)

Learning Objectives:

- Design modular tile systems
- Plan for tile efficiency
- Understand tilemap requirements

Content Breakdown:

- Tile Theory: Modular design principles (20 min)
- Grid Systems: 8×8, 16×16, 32×32 considerations (15 min)
- Tile Types: Solid, platform, slope, decorative (20 min)
- Connection Planning: Wang tiles and auto-tiling (15 min)
- Memory Optimization: Tile reuse strategies (10 min)
- Documentation: Creating tile usage guides (10 min)

Deliverable: Tileset plan document with grid layouts

Session 6.2: Core Tile Creation (2 Hours)

Learning Objectives:

- Create base terrain tiles
- Master seamless tiling
- Develop consistent art style

Content Breakdown:

- Ground Tiles: Basic floor and platform tiles (25 min)
- Wall Systems: Vertical surfaces and edges (25 min)
- Corner Pieces: Inside and outside corners (20 min)
- Transition Tiles: Connecting different terrain types (20 min)
- Testing Patterns: Ensuring seamless connections (15 min)
- Style Refinement: Consistent shading and detail (15 min)

Deliverable: 20-30 core tiles with seamless tiling

Session 6.3: Decorative Elements & Props (1.5 Hours)

Learning Objectives:

- Design environmental storytelling elements
- Create reusable prop library
- Balance detail with readability

Content Breakdown:

- Background Elements: Trees, rocks, structures (25 min)
- Interactive Props: Doors, switches, collectibles (20 min)
- Atmospheric Details: Particles, fog, lighting effects (15 min)
- Foreground Elements: Grass, chains, overlays (15 min)
- Prop Variations: Creating variety efficiently (10 min)
- Organization: Prop sheet layout (5 min)

Deliverable: Complete prop and decoration sheet

Session 6.4: Platform-Specific Optimization (1 Hour)

Learning Objectives:

- Adapt tilesets for each platform
- Optimize for memory constraints
- Maintain visual consistency

Content Breakdown:

- GBStudio Tiles: 4-color conversion, memory limits (20 min)
- NES Tiles: CHR organization, attribute tables (20 min)
- Godot Tiles: Autotile configuration, collision setup (15 min)
- Testing: Platform-specific validation (5 min)

Deliverable: Platform-optimized tileset exports

Module 7: UI System Design (4 Hours)

Session 7.1: UI/UX Principles for Pixel Art (1 Hour)

Learning Objectives:

- Understand pixel art UI challenges
- Learn readability optimization
- Master visual hierarchy

Content Breakdown:

- Pixel UI Theory: Clarity vs decoration balance (15 min)
- Typography: Pixel fonts and readability (15 min)
- Color Usage: Contrast and accessibility (10 min)
- Visual Hierarchy: Size, color, position strategies (10 min)
- Consistency Rules: Establishing UI style guide (10 min)

Deliverable: UI style guide document

Session 7.2: Core UI Elements (1.5 Hours)

Learning Objectives:

- Create comprehensive UI kit
- Design scalable components
- Ensure platform compatibility

Content Breakdown:

- Buttons: States, sizes, and styles (20 min)
- Panels: Windows, dialogs, menus (20 min)
- Progress Bars: Health, mana, experience (15 min)
- Icons: Items, abilities, status effects (20 min)
- Cursors: Pointer, hand, loading states (10 min)
- Typography Integration: Text boxes and labels (5 min)

Deliverable: Complete UI element library

Session 7.3: HUD Design & Implementation (1 Hour)

Learning Objectives:

- Design effective game HUD
- Balance information density
- Create responsive layouts

Content Breakdown:

- HUD Planning: Information architecture (15 min)
- Health Systems: Hearts, bars, numbers (15 min)
- Resource Displays: Currency, ammo, inventory (15 min)

- Mini-maps: Simplified world representation (10 min)
- Status Indicators: Buffs, debuffs, alerts (5 min)

Deliverable: Complete HUD mockup with all elements

Session 7.4: Menu Systems & Screens (30 Minutes)

Learning Objectives:

- Design cohesive menu systems
- Create title and pause screens
- Implement settings interfaces

Content Breakdown:

- Title Screen: Logo, menu options, background (10 min)
- Pause Menu: Quick access design (5 min)
- Settings Screen: Sliders, toggles, dropdowns (10 min)
- Game Over: Results and retry options (5 min)

Deliverable: Complete menu screen designs

Module 8: Asset Integration & Export (2 Hours)

Session 8.1: Sprite Sheet Organization (1 Hour)

Learning Objectives:

- Master sprite sheet creation
- Optimize texture memory
- Implement naming conventions

Content Breakdown:

- Packing Strategies: Manual vs automatic packing (15 min)
- Animation Sheets: Frame organization methods (15 min)
- Texture Atlases: Combining multiple assets (10 min)
- Metadata Generation: JSON, XML exports (10 min)
- Version Control: Asset naming and organization (10 min)

Deliverable: Organized sprite sheets with metadata

Session 8.2: Platform Export Mastery (1 Hour)

Learning Objectives:

- Execute platform-specific exports
- Validate technical requirements
- Create delivery packages

Content Breakdown:

- GBStudio Export: File structure and testing (20 min)
- NES Export: CHR conversion and validation (20 min)
- Godot Export: Import settings and testing (15 min)
- Documentation: Asset usage guides (5 min)

Deliverable: Platform-ready asset packages

TIER 3: PROFESSIONAL INTEGRATION (15-20 Hours)

Module 9: Advanced Animation Techniques (4 Hours)

Session 9.1: Effects Animation (1.5 Hours)

Learning Objectives:

- Create dynamic particle effects
- Master impact and explosion animations
- Design magical and sci-fi effects

Content Breakdown:

- Fire Effects: Flame animation principles (20 min)
- Water/Liquid: Splash and flow animations (20 min)
- Explosions: Impact frames and debris (15 min)
- Magic Effects: Sparkles, auras, beams (20 min)
- Environmental: Wind, dust, fog animation (10 min)
- Optimization: Reducing frame count efficiently (5 min)

Deliverable: Effects animation library

Session 9.2: Advanced Character Animation (1.5 Hours)

Learning Objectives:

- Create combat animations

- Design emotional expressions
- Master complex state transitions

Content Breakdown:

- Attack Animations: Melee and ranged attacks (25 min)
- Damage States: Hit reactions and knockback (15 min)
- Special Moves: Signature character abilities (20 min)
- Facial Expressions: Emotion in pixels (15 min)
- Death Animations: Dramatic conclusions (10 min)
- State Blending: Smooth transitions (5 min)

Deliverable: Complete character animation set

Session 9.3: Cutscene & Cinematic Sprites (1 Hour)

Learning Objectives:

- Design larger narrative sprites
- Create dialogue portraits
- Implement cutscene assets

Content Breakdown:

- Portrait Creation: Detailed character faces (20 min)
- Expression Sets: Multiple emotional states (15 min)
- Cutscene Sprites: Larger, detailed versions (15 min)
- Narrative Elements: Story-specific assets (10 min)

Deliverable: Cutscene asset collection

Module 10: Tiled Integration Mastery (3 Hours)

Session 10.1: Advanced Tiled Setup (1 Hour)

Learning Objectives:

- Configure Tiled for game development
- Master tileset import and management
- Create custom properties and objects

Content Breakdown:

- Project Setup: Folder structure and organization (10 min)
- Tileset Import: From Aseprite to Tiled workflow (15 min)
- Custom Properties: Collision, triggers, metadata (15 min)
- Object Layers: Enemies, items, spawns (10 min)
- Automation Rules: Auto-tiling configuration (10 min)

Deliverable: Configured Tiled project template

Session 10.2: Level Design Workshop (1.5 Hours)

Learning Objectives:

- Build complete game level
- Implement environmental storytelling
- Optimize for gameplay flow

Content Breakdown:

- Level Planning: Layout and flow design (15 min)
- Tile Painting: Efficient level construction (25 min)
- Decoration Placement: Visual interest and guidance (15 min)
- Collision Setup: Walkable vs solid areas (15 min)
- Object Placement: Enemies, items, triggers (15 min)
- Testing: Playability and visual review (5 min)

Deliverable: Complete playable level

Session 10.3: Export & Engine Integration (30 Minutes)

Learning Objectives:

- Export levels for game engines
- Implement in target platforms
- Troubleshoot common issues

Content Breakdown:

- Export Formats: JSON, TMX, custom formats (10 min)
- Engine Import: GBStudio, NESmaker, Godot (10 min)
- Troubleshooting: Common integration issues (10 min)

Deliverable: Integrated level in game engine

Module 11: Production Pipeline Optimization (4 Hours)

Session 11.1: Workflow Automation (1.5 Hours)

Learning Objectives:

- Create Aseprite scripts and extensions
- Automate repetitive tasks
- Build custom tools

Content Breakdown:

- Lua Scripting Basics: Aseprite API introduction (20 min)
- Batch Processing: Multiple file operations (20 min)
- Custom Exporters: Automated export scripts (20 min)
- Extension Creation: Building tools for team (20 min)
- Testing & Debugging: Script validation (10 min)

Deliverable: Custom automation script library

Session 11.2: Version Control & Collaboration (1 Hour)

Learning Objectives:

- Implement Git for pixel art
- Manage team collaboration
- Handle merge conflicts

Content Breakdown:

- Git Setup: Repository structure for art (15 min)
- Binary Files: Managing .aseprite files (15 min)
- Collaboration Workflow: Branches and reviews (15 min)
- Conflict Resolution: Handling art merges (10 min)
- Documentation: Style guides and wikis (5 min)

Deliverable: Version controlled project repository

Session 11.3: Quality Assurance Systems (1 Hour)

Learning Objectives:

- Establish QA processes

- Create testing procedures
- Implement feedback systems

Content Breakdown:

- Checklist Creation: Technical requirements (15 min)
- Visual Testing: Consistency checks (15 min)
- Performance Testing: Memory and rendering (15 min)
- Feedback Integration: Review processes (10 min)
- Iteration Workflow: Refinement cycles (5 min)

Deliverable: QA checklist and testing documentation

Session 11.4: Asset Documentation (30 Minutes)

Learning Objectives:

- Create comprehensive documentation
- Build usage guides
- Establish naming conventions

Content Breakdown:

- Style Guides: Visual standards documentation (10 min)
- Technical Specs: Requirements and constraints (10 min)
- Usage Examples: Implementation guides (10 min)

Deliverable: Complete asset documentation package

Module 12: Portfolio Development & Industry Prep (4 Hours)

Session 12.1: Portfolio Curation (1.5 Hours)

Learning Objectives:

- Select best work for portfolio
- Create compelling presentations
- Build online presence

Content Breakdown:

- Work Selection: Choosing strongest pieces (20 min)
- Presentation Format: GIFs, videos, stills (25 min)

- Context Creation: Project descriptions (20 min)
- Platform Strategy: ArtStation, Twitter, portfolio sites (15 min)
- SEO Optimization: Discoverability tactics (10 min)

Deliverable: Curated portfolio with 10-15 pieces

Session 12.2: Demo Reel Creation (1.5 Hours)

Learning Objectives:

- Compile animation showcase
- Edit compelling video content
- Optimize for social media

Content Breakdown:

- Content Planning: Shot list and timing (15 min)
- Capture Methods: Recording clean footage (20 min)
- Video Editing: Cuts, transitions, music (30 min)
- Format Optimization: Platform requirements (15 min)
- Thumbnail Creation: Eye-catching previews (10 min)

Deliverable: 60-90 second demo reel

Session 12.3: Industry Standards & Practices (30 Minutes)

Learning Objectives:

- Understand industry requirements
- Learn standard practices
- Prepare for professional work

Content Breakdown:

- Industry Standards: Common specifications (10 min)
- Contract Basics: Freelance considerations (10 min)
- Rate Setting: Pricing your work (10 min)

Deliverable: Industry preparation checklist

Session 12.4: Networking & Growth Strategies (30 Minutes)

Learning Objectives:

- Build professional network
- Engage with pixel art community
- Plan continuous learning

Content Breakdown:

- Community Engagement: Forums, Discord, social media (10 min)
- Game Jams: Participation strategies (10 min)
- Continuous Learning: Staying current (10 min)

Deliverable: Professional development plan

Assessment & Certification Criteria

Tier 1 Completion Requirements

- All session deliverables completed
- Pass technical knowledge quiz (80%+)
- Submit foundation portfolio (5 pieces)

Tier 2 Completion Requirements

- Complete character sprite with 5 animations
- Full tileset with 30+ tiles
- Comprehensive UI system
- Pass practical skills assessment

Tier 3 Completion Requirements

- Integrated game level in Tiled
- Automated workflow demonstration
- Professional portfolio with demo reel
- Industry-ready asset package

Final Certification Project

Create a complete asset package for a mini-game including:

- Playable character with 8+ animations
- Environment tileset (40+ tiles)
- Complete UI system
- 3 enemy types with animations

- Effects and particle animations
- Fully integrated Tiled level
- Documentation and style guide
- Platform exports for all three targets

Total Course Duration: 47-54 hours of guided instruction plus 20-30 hours of practice exercises and final project work.