Serious Game Design Workshop

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FORM GROUPS WITH A MIX OF EACH ROLE

PICK A ROLE THAT MOST CLOSELY MATCHES YOUR EXPERIENCE

A. Instruction – e.g., Instructional Designer, Trainer, Instructor

B. Game – e.g., Game Designer, Game Developer, Producer

C. Military Expert – e.g., Experience with procedures/tactics/equipment

D. Technical/Management – e.g., Manager, Software Developer, Artist

- **Apply iterative methods for designing a learning game**
- **Apply methods to blend gaming and learning in the story, goals, instruction and gameplay of a serious game**
- **Perform the basic tasks involved when starting a serious game design effort**
- **Work effectively with other disciplines to design a serious game for learning**
- **Value the use of design patterns in your approach**
- **Design instructional mechanics and situations that apply your instructional techniques and support your gameplay**
- **Review and revise your design**

Workshop Flow

- **What's involved in creating a serious game for learning?**
  - Team building exercise
- **Analysis**
  - Exercise 1: What are our requirements, domain and audience?
  - Exercise 2: What's our game concept?

    <Break>

  - Exercise 3: What are our learning objectives? What are we assessing?
- **Core Design**
  - Exercise 4: What's our story?

    <Break>

  - Exercise 5: How are we teaching?

  - Exercise 6a: What's our gameplay?

    <Where's our Lunch?>

  - Exercise 6b: What shouldn't be in our game?

- **Experience Design**
  - Exercise 7: Goal elements
  - Exercise 8: Control elements

    <Break>

  - Exercise 9: Action elements
  - Exercise 10: Assessment elements
  - Exercise 11: Guidance elements

    <Break>

  - Exercise 12: Feedback elements
- **Revise, revise, revise**
  - Exercise 13: In the player's shoes
  - Exercise 14: Tuning
  - Exercise 15: Real-life intervenes
- **What did we learn?**
  - Recap exercise

Let's Get Started

Rules of Engagement

- **Assign a scribe for each exercise**
- **Group exercises will be <u>creative</u> exercises (sometimes all together, sometimes in pairs)**
- **<u>All</u> ideas are valuable – make sure to note them all**
- **Keep things dynamic and ensure all viewpoints are heard**
  - **Group leaders will change**
  - **Group leader should keep an eye on the time**
  - **Group leader should report out to larger audience**
- **We're here to learn, so let's all throw some fun in**
- **Raise hand to ask questions during exercises**

Team Building Exercise

- **You have *5 minutes* total**

- **Each member of group**
  - **Briefly discuss who you are and what your background is**
  - **Say the #1 challenge you see in serious game design and development**
    - **No repeats**
    - **(Scribe: Capture all challenges)**

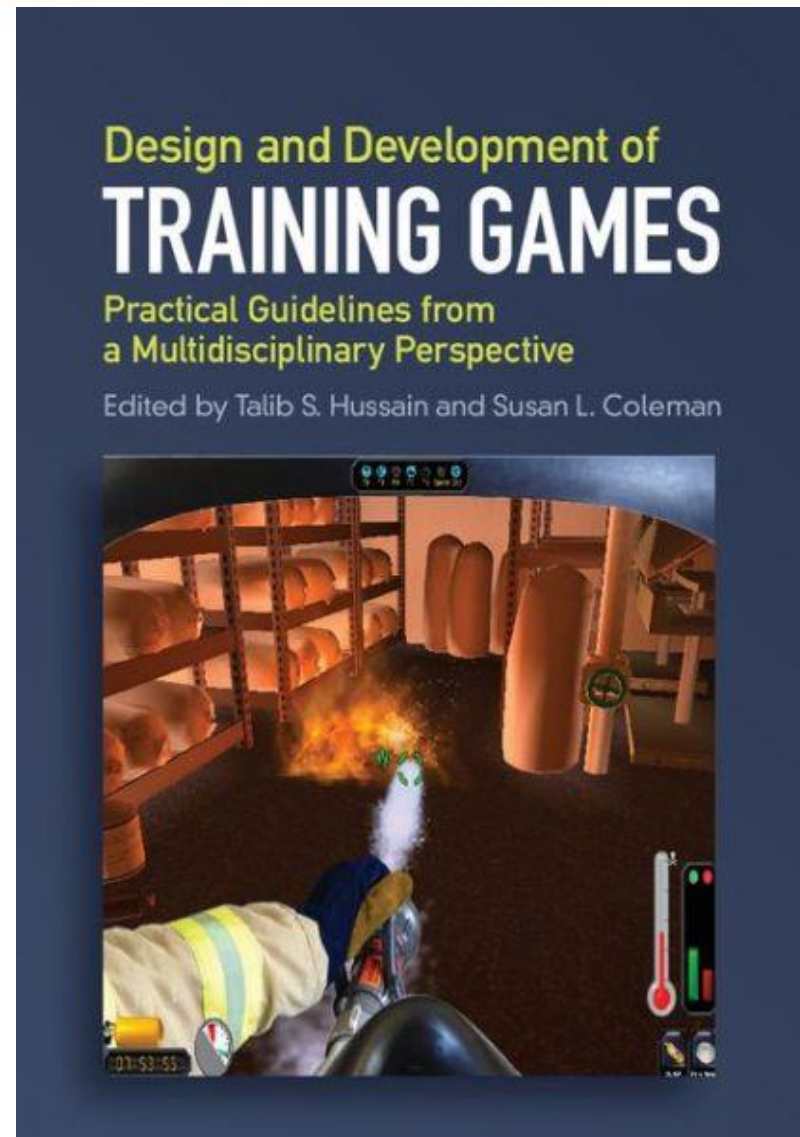 - **When you've all spoken, pick a name for your group together**

What does it take to create a learning game?

- **Requires a Multi-Disciplinary Effort**
  - **Instructional designer, game designer, domain expert, developer, artist**
  - **Creating a good serious game involves making a number of explicit tradeoffs to balance budget, learning scope, depth of training and gaming features.**
  - **Get all stakeholders involved early**

- **Careful attention to blending gaming and instruction throughout an (agile) iterative development methodology**
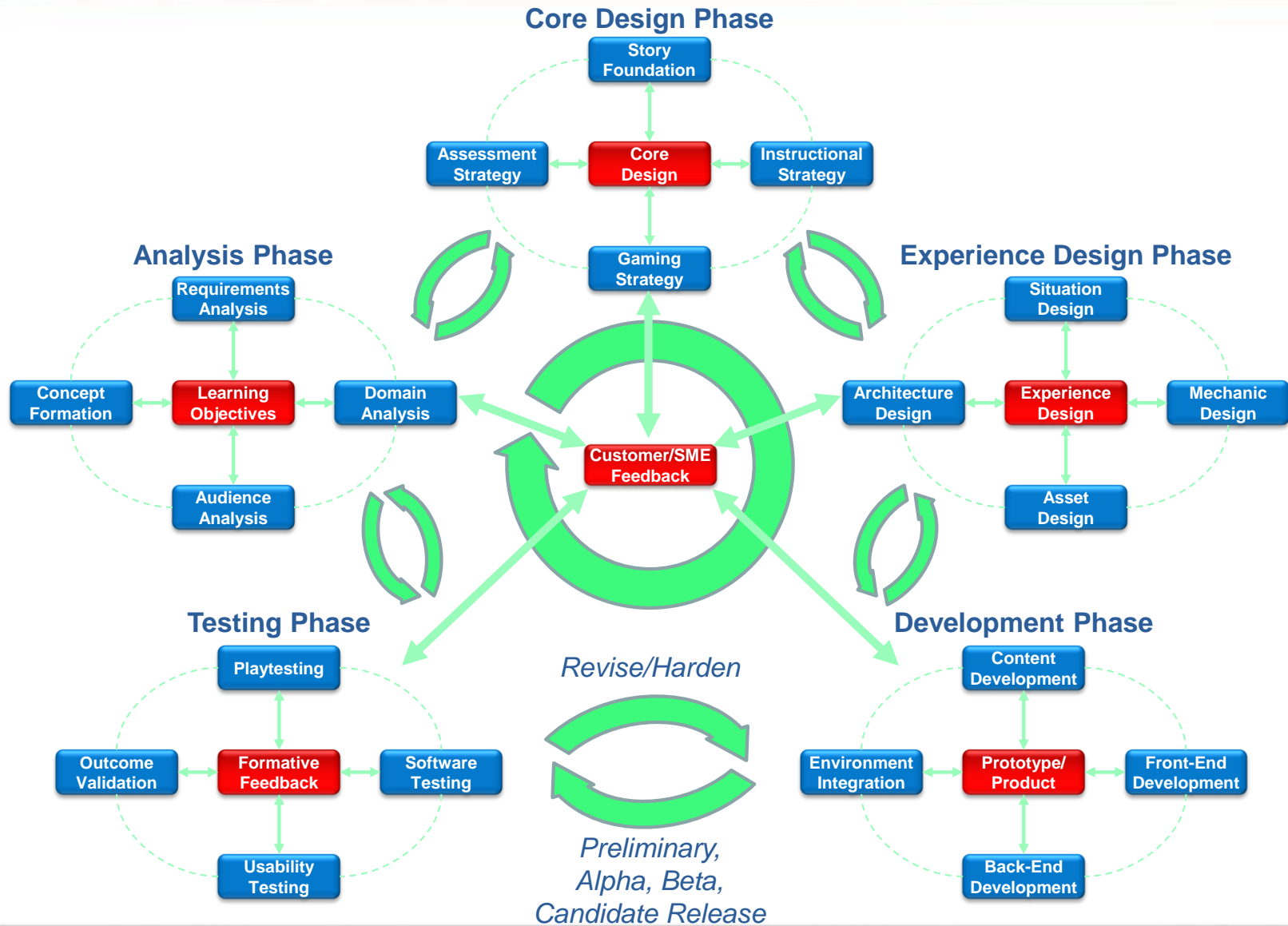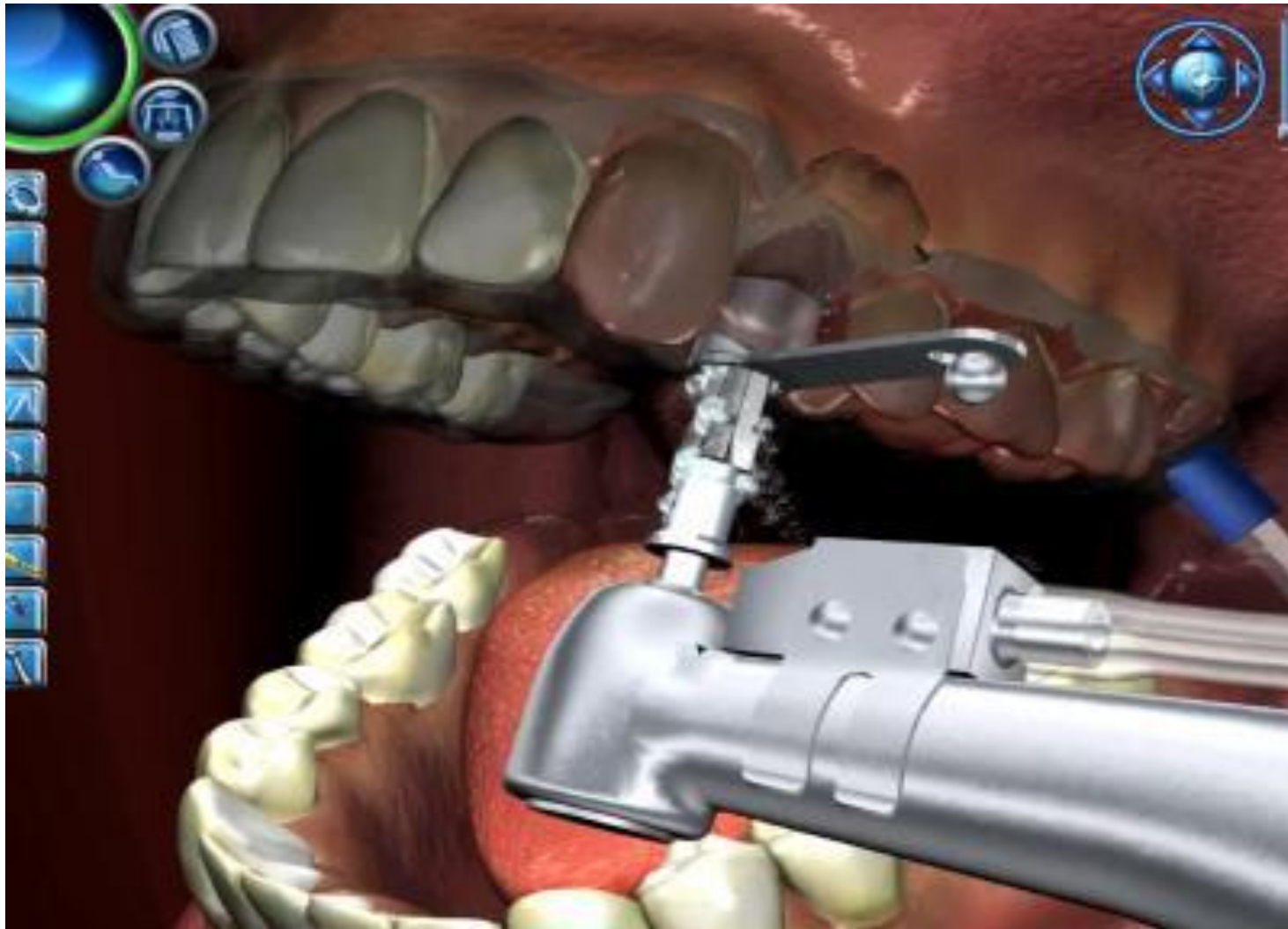
There's a Book!

- **Book was released in 2014**
- **Aligns with this tutorial content**

- **Order online at Amazon, Barnes & Noble, etc.**
  - **Shop around – some good prices available.**

Design and Development of
TRAINING GAMES
Practical Guidelines from
a Multidisciplinary Perspective

Edited by Talib S. Hussain and Susan L. Coleman

Multi-Disciplinary Development Methodology for Learning Games

Core Design Phase
- Story Foundation
- Assessment Strategy
- Core Design
- Instructional Strategy
- Gaming Strategy

Analysis Phase
- Requirements Analysis
- Concept Formation
- Learning Objectives
- Domain Analysis
- Audience Analysis

Experience Design Phase
- Situation Design
- Architecture Design
- Experience Design
- Mechanic Design
- Asset Design

Customer/SME Feedback

Testing Phase
- Playtesting
- Outcome Validation
- Formative Feedback
- Software Testing
- Usability Testing

Development Phase
- Content Development
- Environment Integration
- Prototype/Product
- Front-End Development
- Back-End Development

Revise/Harden

Preliminary, Alpha, Beta, Candidate Release

Learning Games Span a Wide Range

Virtual Dental Implant Trainer (BreakAway)
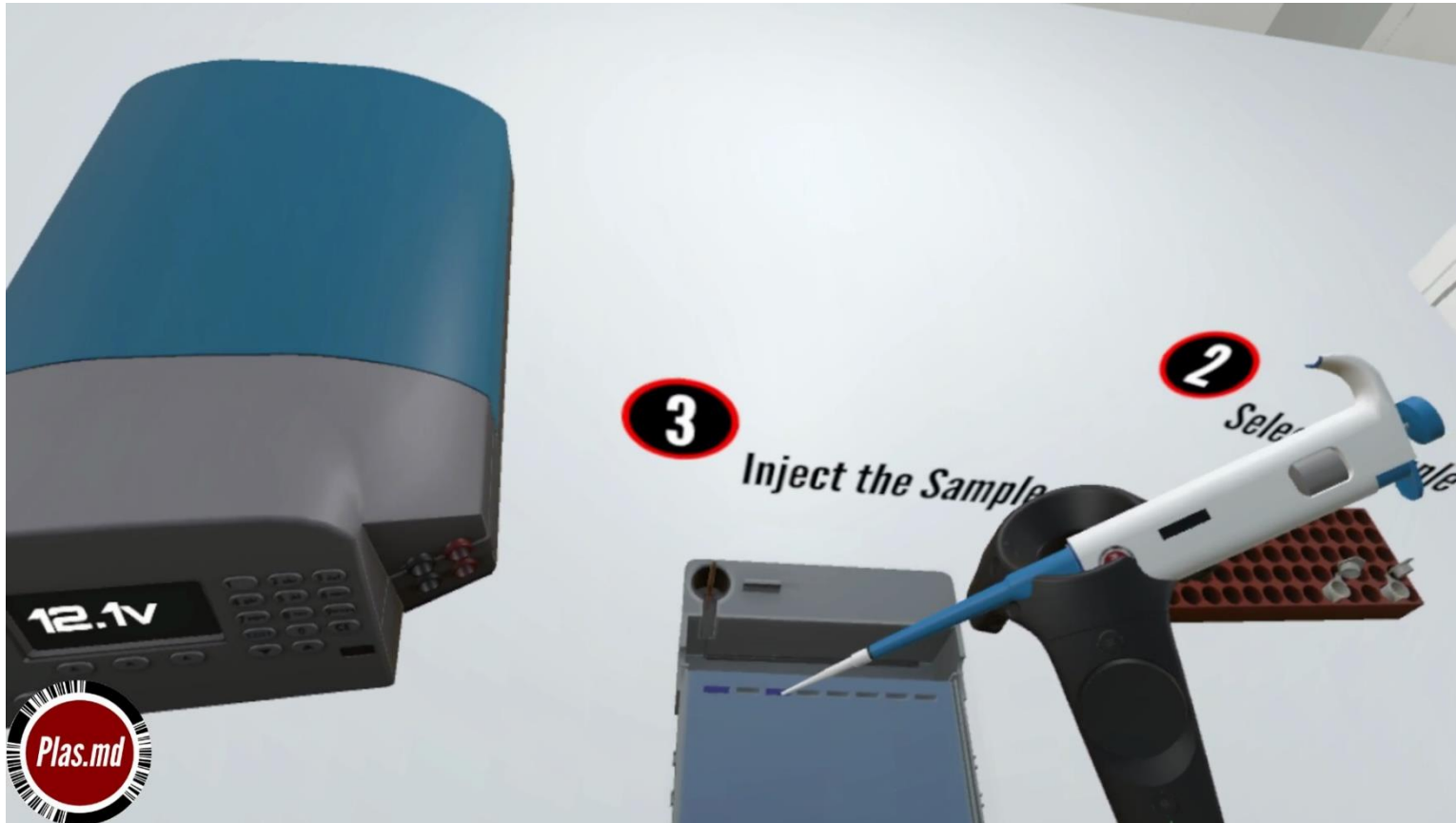
Learning Games Span a Wide Range

SHARD VR Microbiology Lab (Plas.md)

Learning Games Span a Wide Range

Pediatric Vital Signs (BreakAway Games)

Learning Games Span a Wide Range

Poconos (IDEAS)

Learning Games Span a Wide Range

Bionautica (Plas.md)

Learning Games Span a Wide Range

The Descension (JANUS Research)

Learning Games Span a Wide Range

DARWARS Ambush! (BBN)

High Level Considerations

Learning game design choices are driven by:

- **Requirement constraints**
  - **Complexity of training**
  - **Level of fidelity**
  - **Limits on learning time**
  - **Role in the larger curriculum**
- **Development constraints**
  - **Availability of game engine / tools**
  - **Cost of art / modeling**
  - **Development schedule constraints**
  - **Amount of subject matter expertise required**
  - **Challenge of advanced features (speech recognition, AI, etc.)**

Common Types of Successful Learning Games

DARWARS Ambush! (BBN) Computer Based Corpsman Training System (ECS) RISK Bridge! (BreakAway Games)

- **Mission rehearsal, 3D team trainer with avatars but minimal embedded instruction**
  - **Strength: Simple to develop; High impact**
  - **Challenge: Requires significant involvement of human trainers**

- **Individual 3D trainer with/without avatars, performing tasks in the virtual environment with embedded guidance**
  - **Strength: Readily accepted by wide range of students; Repeatable activity**
  - **Challenge: Designing effective guidance that does not detract from game experience**

- **Abstracted (fantasy) game, provides instruction in an unrealistic or highly abstract setting**
  - **Strength: Can be highly engaging**
  - **Challenge: Often difficult to get a "green-light"; Care needed to ensure learning transfers to real world**

Common Types of Successful Learning Games
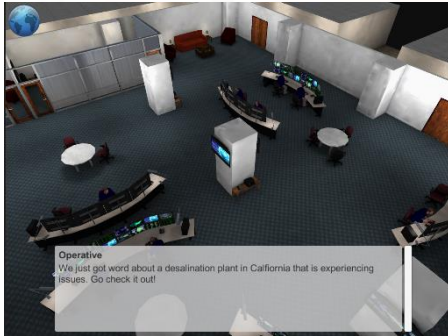
NullOps (JANUS Research)

VESSEL Damage Control Trainer (BBN)

Practice Marketing (Muzzy Lane Software)

- **Individual trainer 2D casual game showing application of procedures in context**
  - **Strength: Simple to develop; Easy to understand**
  - **Challenge: Best for a small number of learning objectives**

- **Game training (2D or 3D) that assumes fundamental knowledge and provides practice at applying skills in authentic context and opportunity to fail safely**
  - **Strength: Solid underpinning for many successful games**
  - **Challenge: Targeting practice for right level of performance**

- **Strategy games for exploring multiple decision effects and tradeoffs over time in an appropriate information-based environment**
  - **Strength: Ability to focus on interacting processes**
  - **Challenge: Balancing the game may require many iterations**
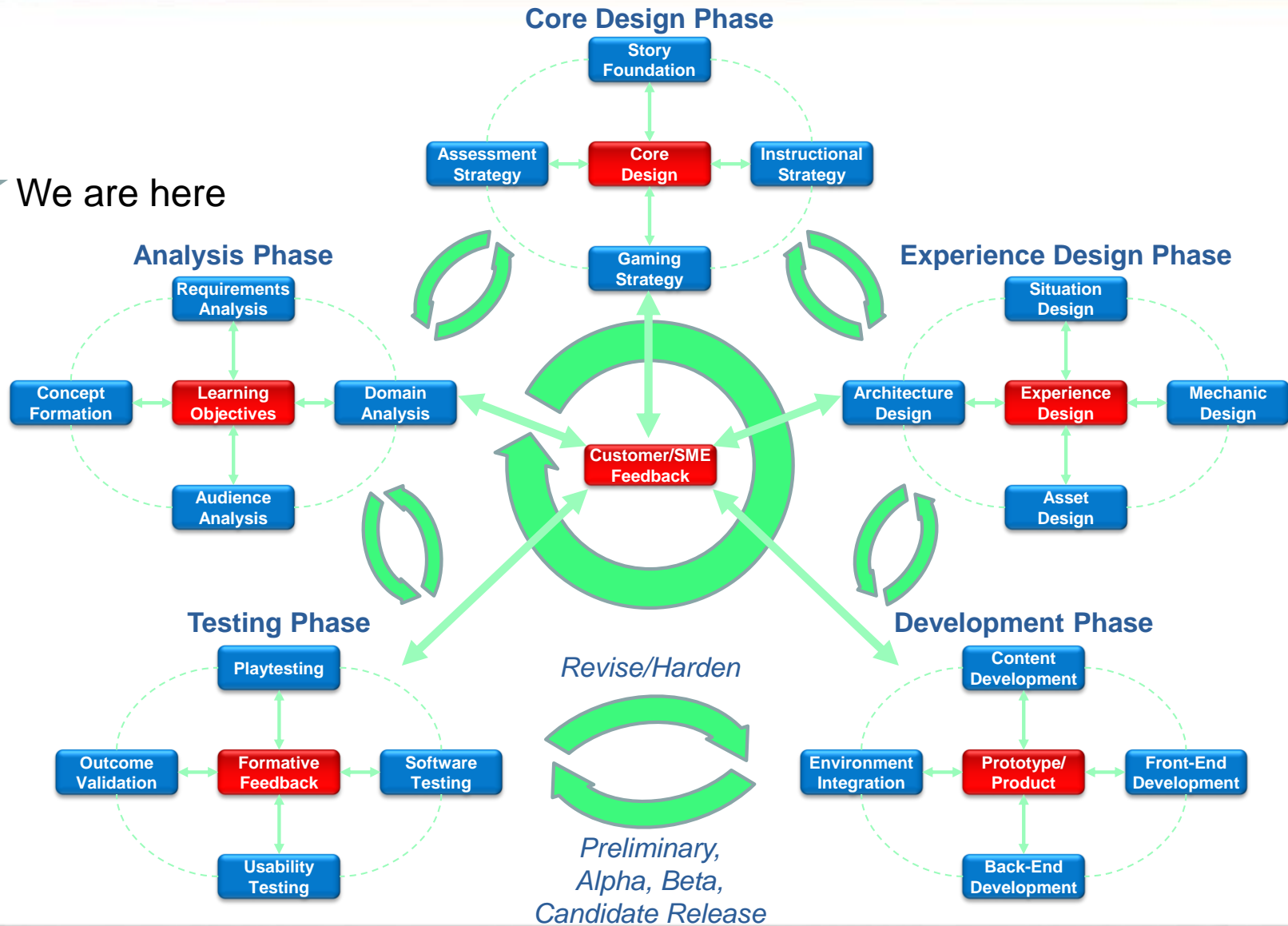
- **We will set the key requirements and some key learning goals**

- **Each group will work on its own game design for their own unique problem**

- **Each group defines their own learning objectives**

- **We will focus on a <u>guided practice</u> approach to instruction**

Analysis

We are here

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A **If you have military SME at your table:**

- **Pick a relevant skill to teach or training problem to address**
  - **E.g., Small unit tactics, Effective communications**

B **If you have a non-military expert at your table (e.g., K-12 instructor, health care professional, mountain climber, scuba diver, auto mechanic, chef, etc.):**

- **Choose a skill to teach or problem to address**

C **Pick a topic most of you are familiar with (e.g., driving, planning a trip, giving effective feedback, etc.)**

- **Choose a skill to teach or problem to address**

Exercise #1: What are our requirements, domain and audience?

Discuss only one of #1-5 in your group (as assigned), plus everyone come up with 1 anecdote #6 (scribe final results on pad). *5 minutes*

1. **Top 2 Deployment constraints**   **[Requirements]**

2. **Top 2 Characteristics of students**   **[Audience]**

3. **Top 2 Issues to address**   **[Domain]**

4. **Top 2 Desired outcomes**   **[Requirements]**

5. **Top 2 Current training methods and their key weakness**   **[Audience]**

6. **Top 1 Anecdote that illustrates a typical error made by students …and appropriate solution**   **[Domain]**

→ **Report Out.** *2 minutes/group*

Exercise #2: What's our game concept?

On your team, pick one from A and one from B *3 minutes*

A
- **Collaborative trainer (multi-player)**
- **Individual Trainer (single player)**

B
- **Introductory training for novices**
- **Practice environment for novices with some prior training**
- **Reinforcement/Refreshment environment for intermediate/experts**

→ Mark your choice on your flipchart

Break

8 minutes

Learning Objectives

Learning Objectives and Game Goals

- **Learning objectives are the foundation of your game design**
  - **Instructional and game goals must align**
  - **Presentation of game goal to player may differ from specific wording of learning objective(s)**

Learning Objective	Game Goal
Don the correct safety gear for firefighting.	Save your ship and shipmates by putting out the fire in the galley without unnecessarily endangering yourself.
Use proper procedures for extinguishing a Class A fire with a hose.	

- **A good set of explicit game goals motivates the player**
  - **Design of game goals hinges strongly on the characteristics of targeted students**
  - **Influences and influenced by story**
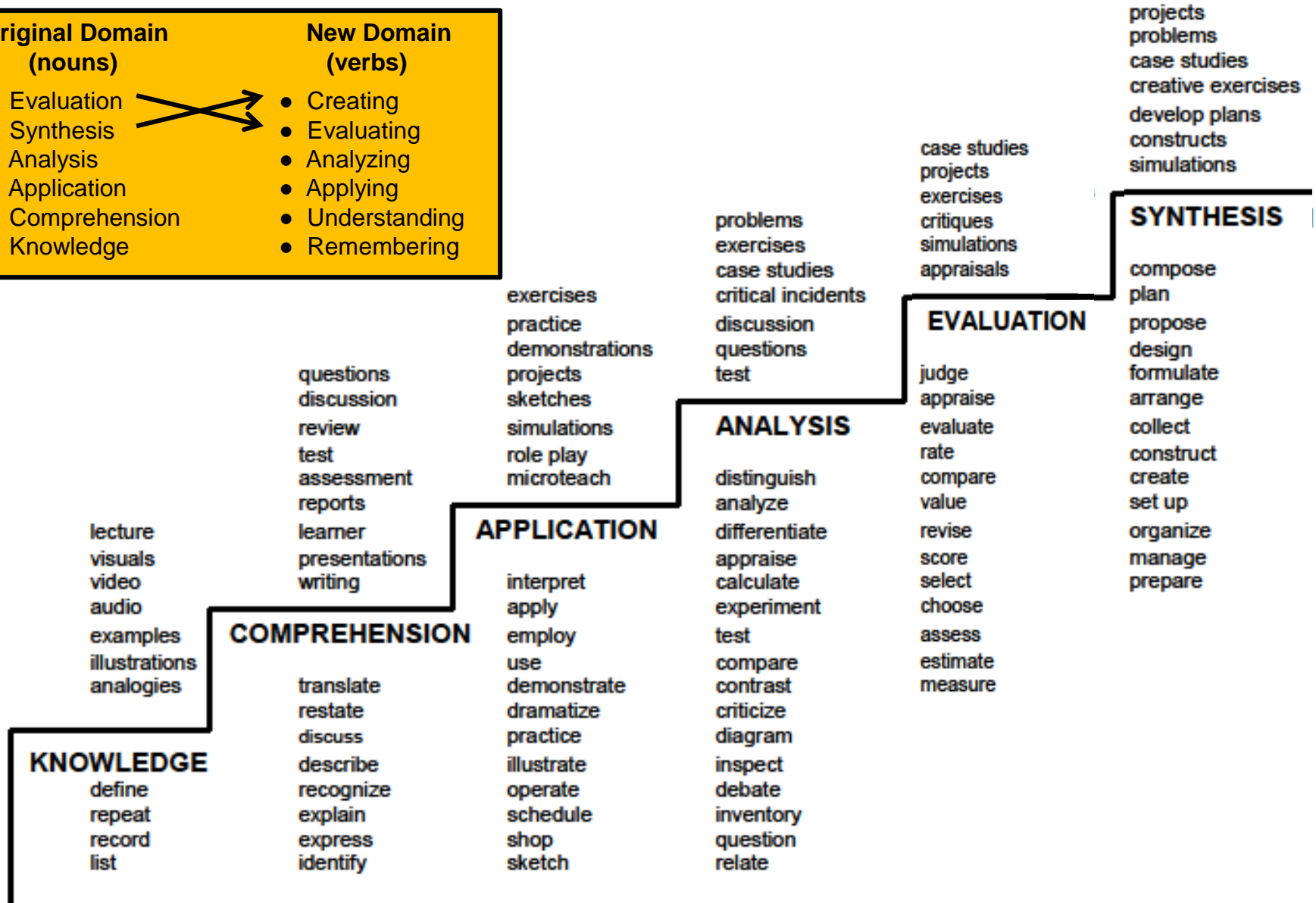
Bloom's Taxonomy & Instructional Strategies

Original Domain (nouns)
- Evaluation
- Synthesis
- Analysis
- Application
- Comprehension
- Knowledge

New Domain (verbs)
- Creating
- Evaluating
- Analyzing
- Applying
- Understanding
- Remembering

SYNTHESIS

projects
problems
case studies
creative exercises
develop plans
constructs
simulations

compose
plan
propose
design
formulate
arrange
collect
construct
create
set up
organize
manage
prepare

EVALUATION

case studies
projects
exercises
critiques
simulations
appraisals

judge
appraise
evaluate
rate
compare
value
revise
score
select
choose
assess
estimate
measure

ANALYSIS

problems
exercises
case studies
critical incidents
discussion
questions
test

distinguish
analyze
differentiate
appraise
calculate
experiment
test
compare
contrast
criticize
diagram
inspect
debate
inventory
question
relate

APPLICATION

exercises
practice
demonstrations
projects
sketches
simulations
role play
microteach

interpret
apply
employ
use
demonstrate
dramatize
practice
illustrate
operate
schedule
shop
sketch

COMPREHENSION

questions
discussion
review
test
assessment
reports
learner
presentations
writing

translate
restate
discuss
describe
recognize
explain
express
identify

KNOWLEDGE

lecture
visuals
video
audio
examples
illustrations
analogies

define
repeat
record
list

- **Based on http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_023989.pdf**

A B C D of Learning Objectives

- **Audience**
  - Who will be doing the learning?

- **Behavior**
  - What specific, observable, measureable action will they take?

- **Conditions**
  - Under what circumstance must they perform?

- **Degree**
  - To what degree must they perform? (Accuracy, time limit)

- **Here is a good reference for this:**
  http://www.wku.edu/ste/objectives/components.php

Exercise #3: What are our learning objectives?

- **Choose objectives.** *8 minutes*
  - **Identify 2 learning objectives that your group feels are most important for your game (scribe on pad)**
    - **If you have an expert, interview them to identify the key issues and related objectives [if not, discuss/decide collaboratively]**
  - **For each objective, identify at least one way to assess successful achievement of the objective**

→ Report Out. *2 minutes/group*

| Learning Objective	Assessment
Don the correct safety gear for firefighting.	The student dons the correct gear within X minutes.
Use proper procedures for extinguishing a Class A fire with a hose.	The student will prepare a hose and then extinguish the fire using the proper motions.

Core Design

Core Design Phase — We are here

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Revise/Harden

Preliminary, Alpha, Beta, Candidate Release

- **Blend → Make every design decision taking both gaming and learning into account**

- **Keep It Simple**

Story Foundation
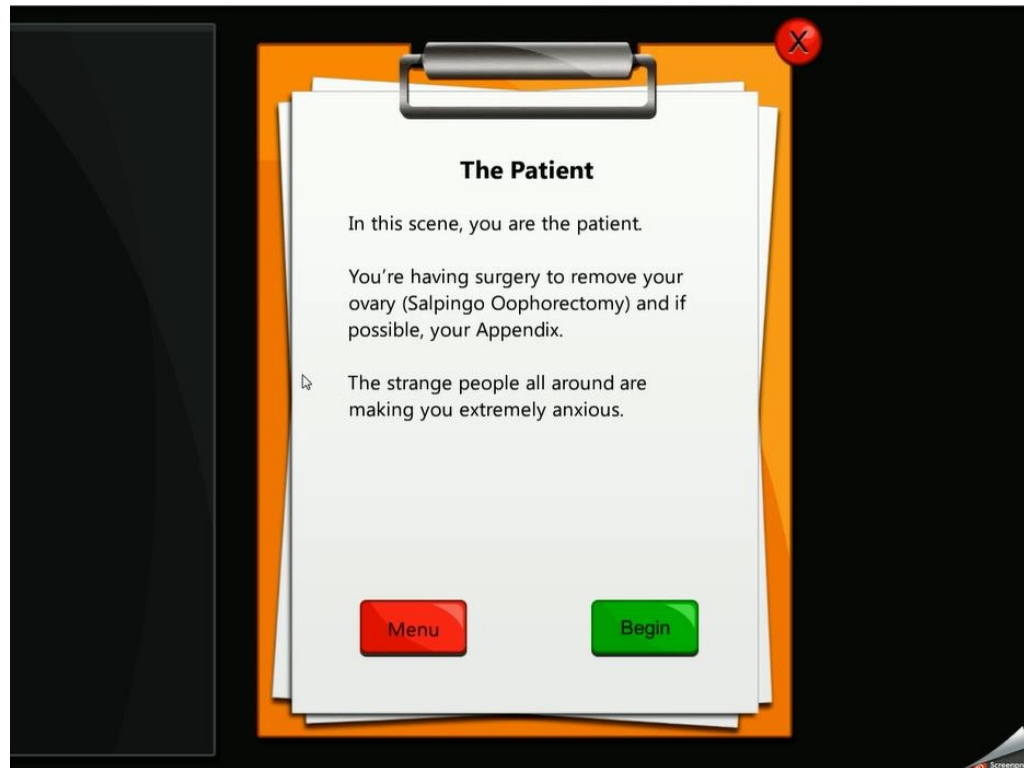
Exercise # 4: What's our story?

1. **Create a Story Arc** *8 minutes*
   - **Review the learning objectives**
   - **What is the Conflict? How will it be resolved?**
   - **What happens at the beginning, middle, end? Align with learning objectives.**

→ **Report Out (All groups)** *1 minute/group*

2. **Design Other Key Story Elements** *12 minutes*
   - **Design a Plot Situation**
     - **What has just happened and what are our characters about to do? What are the key relevant facts, issues? What will the game goal be?**
   - **Design the Setting**
     - **What is the game world? Where are we? Describe the location – when is it, locale, buildings, equipment, season, etc.**
   - **Develop a Character**
     - **Gender, physical characteristics, background, goals and motivation, personal life, work/military life, quirks, relationships, etc.**

→ **Report Out (Facilitator directed)** *10 minutes total*

- **Story choices can drive development of interesting character backgrounds, appealing settings, etc.**

- **Story choices also drive motivating factors – solve the mystery, go on a quest, beat the enemy, save the prince**

- **The story must:**
  - **Carry the learning objectives into the mind of the player**
  - **Provide interesting, meaningful context for the learning objectives**
  - **Stay relevant and not too complex or may increase extraneous load**
  - **As the story in the game unfolds, it captures the progression of instruction**

- **It's important to involve Subject Matter Experts (SMEs) in early creative sessions to inform the team and help focus learning priorities**

- **Plot — Good stories have an arc of action and events that create interest and lead the audience on a journey**

- **Conflict/Resolution — Conflict and resolution create the energy in a story for the characters and the audience**

- **Setting — A story has to take place in a defined "somewhere"**

- **Characters — The audience needs to "see" someone enough like themselves to care about**

- **Voice — Every story has a teller. Voice is the persona of that teller.**

- **Emotion — Good stories contain both "facts" (whether or not they are objectively true), and feelings**

Blending

What are we trying to blend?

- **Gaming**
  → **Entertainment ("Fun")**

- **Learning**
  → **Self-improvement, Mental models, Learning outcomes**

Gaming		Learning
– **Fantasy, Imagination**	⟷	– **Cognition, Behaviors**
– **Suspension of disbelief**	⟷	– **Relevant, Appropriate**
– **Challenging**	⟷	– **Target Expertise Level**
– **Compelling (Senses)**	⟷	– **Authentic / Context for Learning**
– **Motivating (keep playing, intrinsic)**	⟷	– **Motivating (keep learning, extrinsic aspects)**
– **Flow ("in the zone")**	⟷	– **Learning Continuum ("in the zone")**

Learning Game = All of the Above

Break

6 minutes

Instructional Strategy

Instructional Design

- **Creating an instructional game involves many decisions about what to teach when and how to teach it**
  - **Instructional sequencing**
  - **Instructional methods**
  - **Assessment methods**

- **Some guided practice elements (see handout)**
  - **Use of priming**
  - **Feedback techniques**
  - **Use of scaffolding**

1. **Choose 1 or 2 of your learning objectives (from Exercise 1). Answer as many of these questions as you can.** *10 minutes*
   - How do you want the player to learn it?
   - What do you need to have in the game in order to elicit the behavior?
   - What kind of feedback will you use? What kind of guidance?
   - What is a key error you want the players to avoid in the game?
   - What is an example of good performance in the game?
   - (if collaborative trainer) How will different players be differentiated in their roles in the game?
   - (Note: See handout)

→ **Report Out (Facilitator directed)** *10 minutes total*

Guided Practice Elements: Priming

- **Helps learners call forth correct prior knowledge**
  - **Activates prior knowledge**
  - **Compensates for missing prior knowledge**
  - **Minimizes triggering of irrelevant prior knowledge**

- **Use the introduction of the story and game goals to prime learners**
  - **A pre-mission brief**
  - **An anecdote communicated by a character in the game**
  - **A cut-scene to introduce relevant content and context**
  - **Environmental cues**

- **Be careful of distracting or "seductive details"**

- **Balance between timeliness, level of detail & style**

- **Should encourage reflection**

- **Choices about HOW you give feedback have significant impact on perception of flow.**
  - **Ideally, feedback stays in the story**
  - **Consequences – natural vs. direct, recoverable vs. catastrophic**
  - **Verbal feedback – align content with gaming context, don't disrupt experience**
  - **Indirect feedback (e.g., score) may be too obscure to encourage reflection. Make it clear why the score is what it is.**
  - **** Feedback may be critical to maintain flow if the student experiences difficulties in learning**

- **Memory aids**
  - **"What am I supposed to do?"**

- **Help resources**
  - **Avoid "crutches" that can allow a student to complete play without actually making choices that lead to learning.**
    - **"Don't give away the answer"**
    - **Make it available only when needed to help, not all the time.**
  - **Provide access to pre-requisite knowledge to avoid assumptions about the student's state of knowledge**

- **Modeling**
  - **What happens in your virtual world around the student will influence the student.**
  - **Make it count by modeling correct behaviors (or highlighting incorrect behaviors)**

Back to Blending

What are we trying to blend?

- **Gaming**
  - → **Entertainment ("Fun")**

    - **Fantasy, Imagination** ⟷
    - **Suspension of disbelief** ⟷
    - **Challenging** ⟷
    - **Compelling (Senses)** ⟷
    - **Motivating (keep playing, intrinsic)** ⟷
    - **Flow ("in the zone")** ⟷

- **Learning**
  - → **Self-improvement, Mental models, Learning outcomes**

    - **Cognition, Behaviors**
    - **Relevant, Appropriate**
    - **Target Expertise Level**
    - **Authentic / Context for Learning**
    - **Motivating (keep learning, extrinsic aspects)**
    - **Learning Continuum ("in the zone")**

Learning Game = All of the Above

Makes sense, but why?

- **Cognitive Load & Authenticity**
  - **Intrinsic load**
    - **Inherent difficulty of the task or idea being taught**
  - **Extraneous load**
    - **Effort caused by factors not related to the topic of instruction**
  - **Germane load**
    - **Effort involved in processing information relevant to the topic of instruction**
  - → **Avoid Extraneous. Keep it Germane.**
  - → **High cognitive fidelity and sufficient physical fidelity (environment, objects and interactions)**
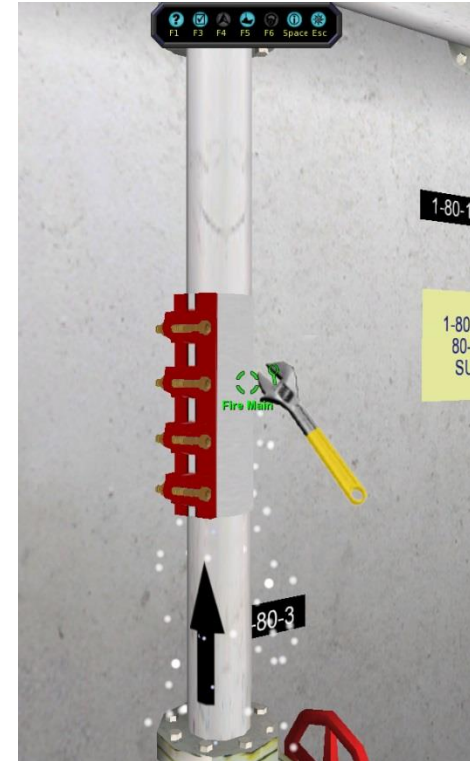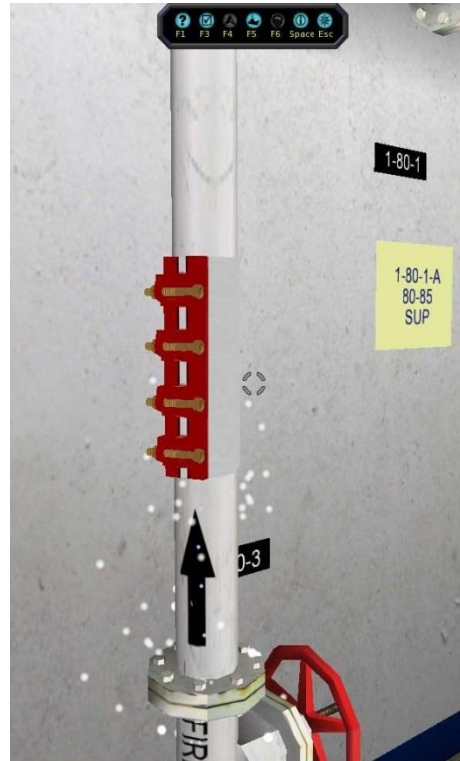- **Flow**
  - **Want experience to be cohesive, not disruptive. Keep them "in the game".**
  - → **Maintain balance between student control, cognitive load and authenticity, while minimizing disruptions**

Cognitive Load & Authenticity

Gaming Strategy

Recap: Workshop Flow

- ✓ **What's involved in creating a serious game for learning?**
  - ✓ **Team building exercise**
- ✓ **Analysis**
  - ✓ **Exercise 1: What are our requirements, domain and audience?**
  - ✓ **Exercise 2: What's our game concept?**

    <Break>
  - ✓ **Exercise 3: What are our learning objectives? What are we assessing?**
- ✓ **Core Design**
  - ✓ **Exercise 4: What's our story?**

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  - ✓ **Exercise 5: How are we teaching?**

  - • **Exercise 6a: What's our gameplay?**

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  - • **Exercise 6b: What shouldn't be in our game?**

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    <Break, Book Raffle>
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  - – **Exercise 12: Feedback elements**
- • **Revise, revise, revise**
  - – **Exercise 13: In the player's shoes**
  - – **Exercise 14: Tuning**
  - – **Exercise 15: Real-life intervenes**
- • **What did we learn?**
  - – **Recap exercise**

Lunch

Be back by 1300 hrs

Exercise #6a: What's our gameplay?

1. **Design your gameplay by discussing all the topics below**.** *10 minutes*

   ** Keep in mind how the gaming element aligns with the instruction

   A. **ACTION: What does the player do in the game?**
      - e.g., the quest, the tasks, the mission

   B. **CONSEQUENCES: What can happen to the player in the game?**
      - e.g., injuries, gain abilities, achieve mission objective, fail

   C. **GAME DIRECTIVES: What does the game do to the player and how does the game "tell" the player?**
      - e.g., increase challenge, add enemies, change the situation

   D. **GOALS: What wins the game and what loses the game?**
      - e.g., align with key performance outcomes or key errors

   E. **MOTIVATION: What makes the player want to keep playing?**
      - e.g., leveling up, gaining equipment, increase score, receive recognition

2. **Iterate and agree on a cohesive gameplay** *10 minutes*

→ **Report Out** *2 minutes/group*

Gameplay

- **Games are all about interactions**
  - **These interactions must align with learning objectives and not distract**
    - **Okay to have some level of whimsy (or gravitas)**
  - **Player interacting with objects, characters, other students and user interface**

- **A game mechanic defines how a specific interaction works**

- **Games put the student in situations where the student has to act and then experience the consequences**
  - **As much as possible, make EVERY choice meaningful for the learning (either positively or negatively)**
  - **Consequences should align with our instructional feedback**

What makes it a game?

- **Set of coordinated gaming elements**
  - Provide a fairly simple set of rules to play by
  - Provide the player with high degree of control over their experience
  - Give player many choices with immediate feedback ("Flow")

- **Give the game an "intrinsic" cohesiveness**
  - Make sure things happen in the game for a reason that makes sense within the context of the game
  - Make sure elements collectively are appealing to player ("Fun")

- **Need a certain amount of "secret sauce", e.g.,**
  - Leverage a known trope or style but add something unique
  - Use innovations – but should be able to count your innovations on < one hand
  - Use graphics to enhance experience, but don't rely solely on them
  - Elicit and exploit sense of challenge, progress, achievement

What doesn't work so well…

- Games that require assessment of purely mental actions
- Heavy emphasis on specific physical activities in the game

- Heavy didactic content to introduce base concepts
- Heavy use of words to convey information and feedback

- Low agency (e.g., linear stories, very limited choices)
- Free exploration with no consequences
- Excessive repetition (might be realistic but will impact flow)

- Poor match between platform and game play mechanics (e.g., long play sessions for mobile)
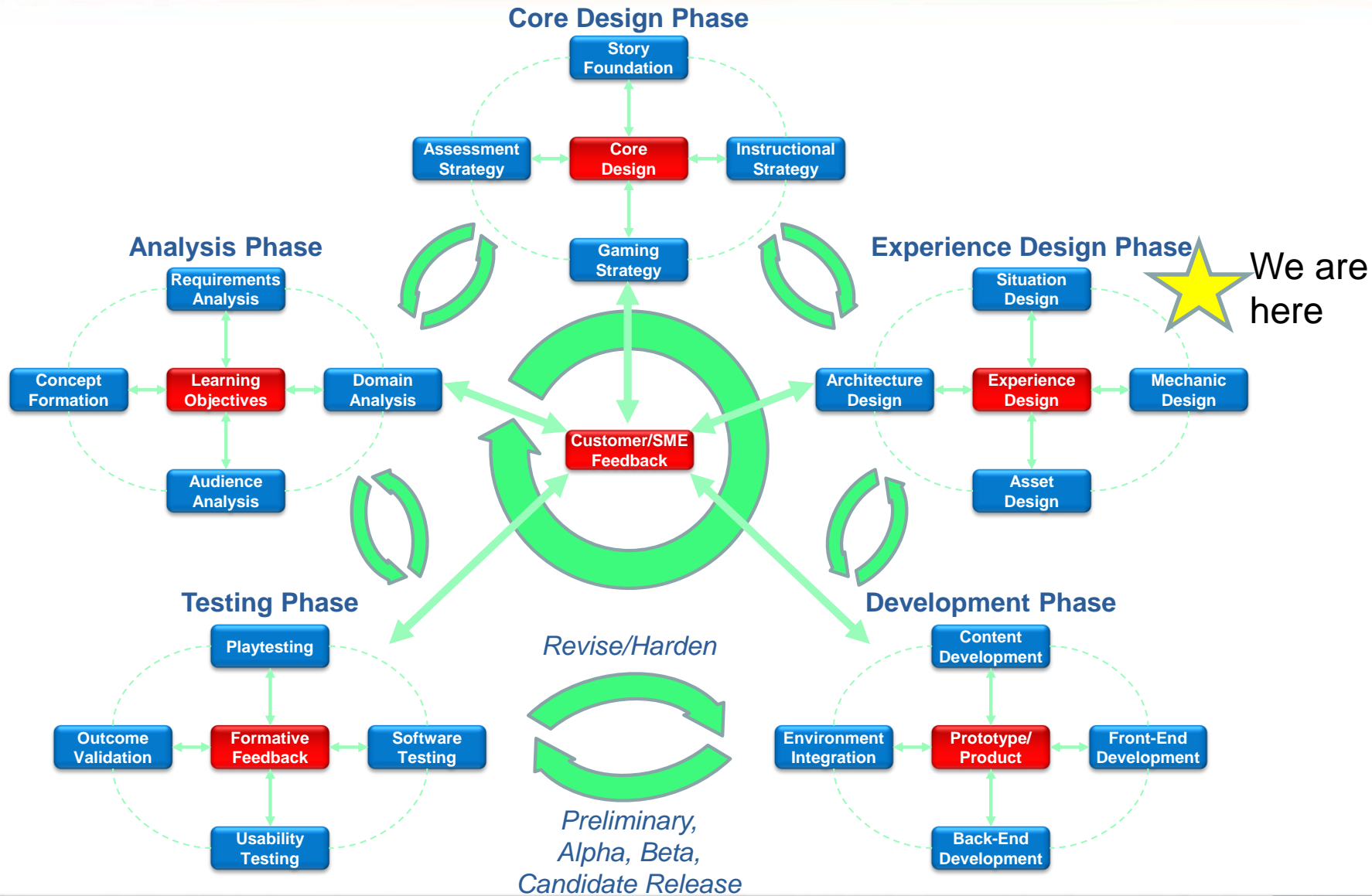- High system requirements that constrain your potential user base

- **Hey! What SHOULDN'T be in our game?**
  - **Why?**

➔ Report Out *2 minutes/group*

Experience Design

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More Keys to Success

- **Be wary of <u>common pitfalls</u>**

- **Use <u>design patterns</u> where possible to help ensure that your game design is easier for your team to create, understand and implement**

- **Explicitly define and iteratively refine your <u>learning game elements</u>**
  - **Key elements: Goals, Control, Actions, Assessment, Guidance and Feedback**

- ***Don't forget: Blend & Keep it Simple.***

Common Pitfalls during Experience Design

- **Multi-disciplinary conflicts and confusion amongst the team when discussing elements of the game and the instruction**
  - "Oh wouldn't that be cool" → Often drives gaming design choices
  - "Is it relevant and teaching at the right level" → Often drives instructional design choices
  - "It needs to be right" → Often drives customer/subject matter expert choices

- **Insufficient attention paid to the specifics of how to implement the instruction so that it works in the game**
  - Underspecified design - especially of what NOT to do instructionally
  - Developers make unintended instructional decisions

- **Gaps between the instructional designer's understanding of the game design and the game developer's understanding of the implementation**

- **Poor usability or effectiveness of gameplay experiences due to conflicting/inconsistent design elements.**

What's a Design Pattern?

- **Design patterns are <u>reusable</u> game elements that:**
  - **Capture the instructional intent <u>and</u> gaming intent for the element**
  - **Consider how the instantiated element should be designed to meet both intents**

- **Provides a shared way for practitioners to discuss how to create understandable solutions with known benefits**
  - **Can capture best practices**
  - **Provides understandable templates with understandable methods**

- **Look at your handout "Feedback Patterns" slide**
  - **Flash feedback**
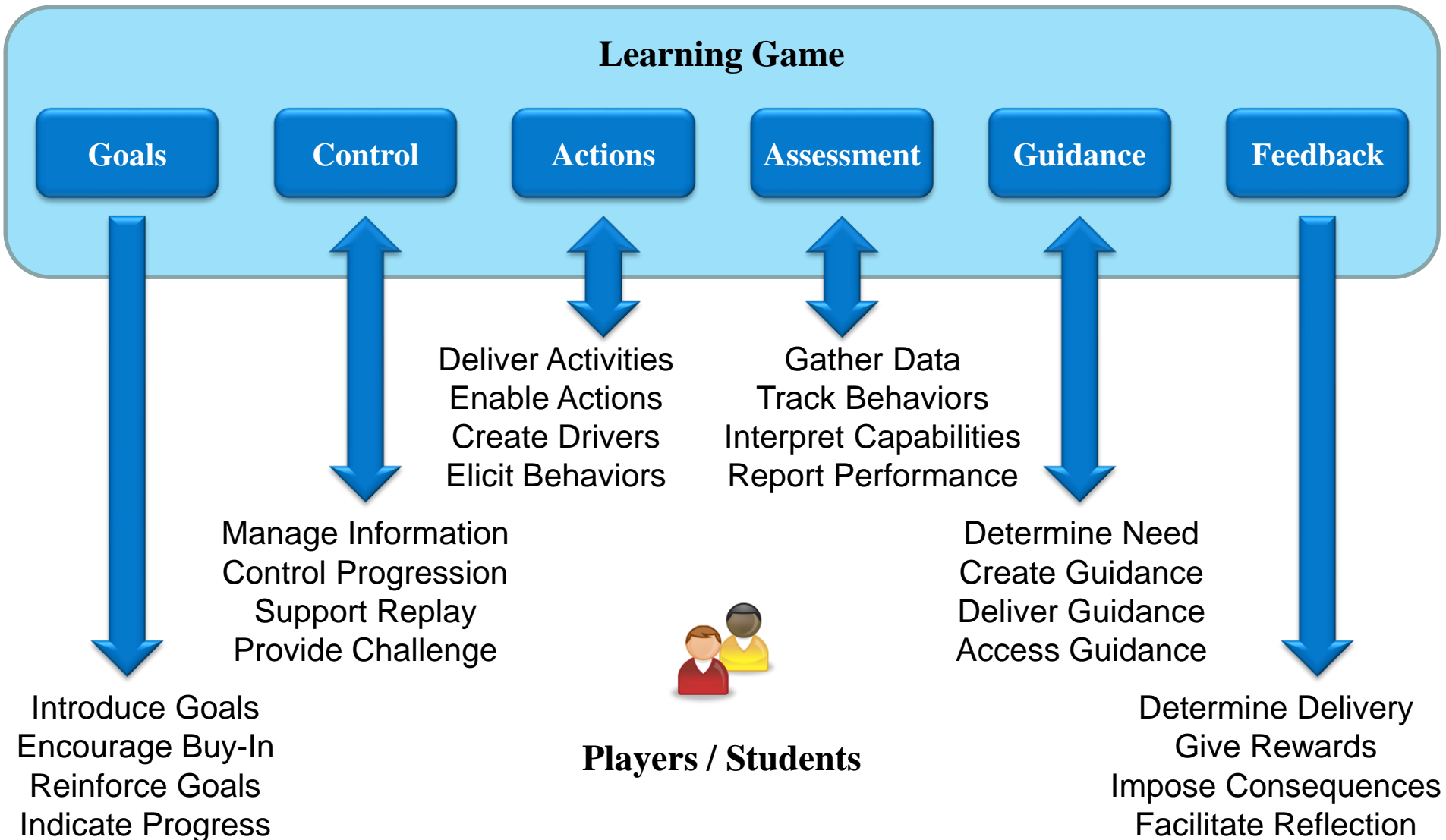 - **Demerit with feedback**
  - **Catastrophic end of the level/game**
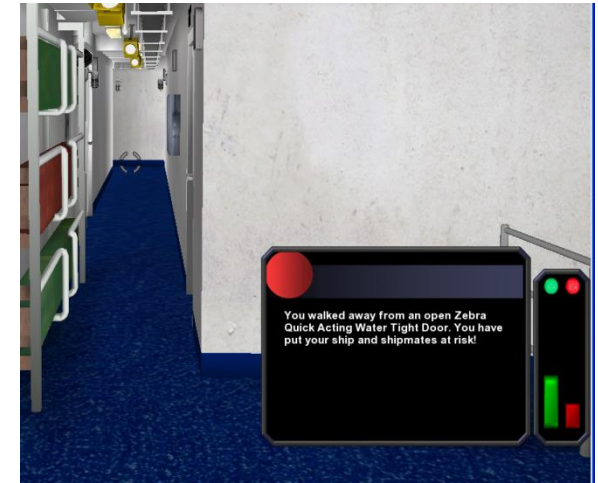
- *Instructional Mechanic* – **A game mechanic that serves a specific instructional purpose**
    - A game is comprised of a set of game mechanics that determine the gaming experience
    - Instruction uses a set of instructional techniques to deliver information, provide learning activities, build desired mental models, and assess performance

- *Instructional Situation* – **Particular experience (context) in the game within which a specific learning objective or set of learning objectives is taught using specific instructional mechanics**
    - A serious game for learning is comprised of a set of instructional situations, appropriately ordered and/or interleaved

Learning Game Elements

Learning Game

| Goals | Control | Actions | Assessment | Guidance | Feedback |

Deliver Activities
Enable Actions
Create Drivers
Elicit Behaviors

Gather Data
Track Behaviors
Interpret Capabilities
Report Performance

Manage Information
Control Progression
Support Replay
Provide Challenge

Determine Need
Create Guidance
Deliver Guidance
Access Guidance

Players / Students

Introduce Goals
Encourage Buy-In
Reinforce Goals
Indicate Progress

Determine Delivery
Give Rewards
Impose Consequences
Facilitate Reflection

- **For exercises 7 – 12, your primary focus will be on designing a single, coherent learning experience within your game**
  - **e.g., a "level" or guided session**

- **Use your instructional and gaming strategies from Exercises 5 and 6**
  - **Iterate and improve your strategies as needed**

- **Example design patterns are provided for each type of element**
  - **See Design Pattern Handout**
  - **Use these, adapt them or define your own game elements from scratch.**

- **You will work in pairs and then regroup for most exercises.**

Goal Elements

Exercise #7: What are our goal elements?

- **Split into pairs in your group and determine the specific instructional situations and instructional mechanics you will use to:** *5 minutes*
  - **Introduce Goals**
  - **Encourage Buy-In**
  - **Reinforce Goals**
  - **Indicate Progress**

- **Regroup and discuss your choices. Revise for consistency.** *5 minutes*

→ Report Out *10 minutes total*

Please refer to your Goal Elements and Design Patterns handouts

Goal Elements

- **Goal elements determine what the player should be trying to accomplish in and with your game, as well as reinforce why they are playing**
  - Align learning objectives with game goals

- *Introduce Goals*:
  - How will your game introduce the learning objectives and game goals to the players?
  - Will the learning objectives be explicitly told to the players or left implicit?
  - At what point(s) in the game will the goals be introduced?

- *Encourage Buy-In*:
  - How will your game encourage players to buy in to the game and realize its value to them?
  - Will you explicitly tie the game to their real-world context?
  - How will you encourage them to want to continue playing over time?

- ***Reinforce Goals*:**
  - How will your game reinforce the goals to the player as gameplay unfolds so that the player continues to try to accomplish those goals?
  - What kind of reminders or motivators are needed and when?
  - Should you constrain the gameplay to specific goal-related actions only?

- ***Indicate Progress*:**
  - How will your game let players know about their progress in meeting their goals?
  - Will you provide objective or subjective indicators?
  - Over what time scales will you indicate progress?

Control Elements

Exercise #8: What are our control elements?

- **Split into pairs in your group and determine the specific instructional situations and mechanics you will use to:** *5 minutes*
  - **Manage Information**
  - **Control Progression**
  - **Support Replay**
  - **Provide Challenge**

- **Regroup and discuss your choices. Revise for consistency. *5 minutes***

→ **Report Out** *10 minutes total*

Please refer to your Control Elements and Design Patterns handouts

Control Elements

- **Control elements determine how the gameplay and instruction unfold as the player interacts with the game.**
  - Balance between enforcing a desired instructional sequencing, shaping the experience for efficient learning and giving the player an appropriate sense of agency (their sense of being able to impact their experience and outcomes)

- *Manage Information*:
  - How will your game manage the player's access to information they need to perform their activities in the game?
  - Should your game parcel out information as the game unfolds?
  - How will information be provided and at what level of detail?

- *Control Progression*:
  - How/when will your game control what happens versus how/when will the player control what happens next?
  - Should the player decide what goals to focus on?
  - How fixed or dynamic is the unfolding of the game?

Control Elements

- *Support Replay*:
  - How and under what conditions will you support replay of the game or parts of the game?
  - Do you need to ensure that replay is meaningfully different from prior play?
  - Should you change the instruction during replay, and in what way?

- *Provide Challenge*:
  - How will your game provide players with appropriate levels of challenge?
  - Does different instruction or gameplay need to be offered for players with different expertise levels?
  - Do you provide the ability for a player to choose the difficulty level?
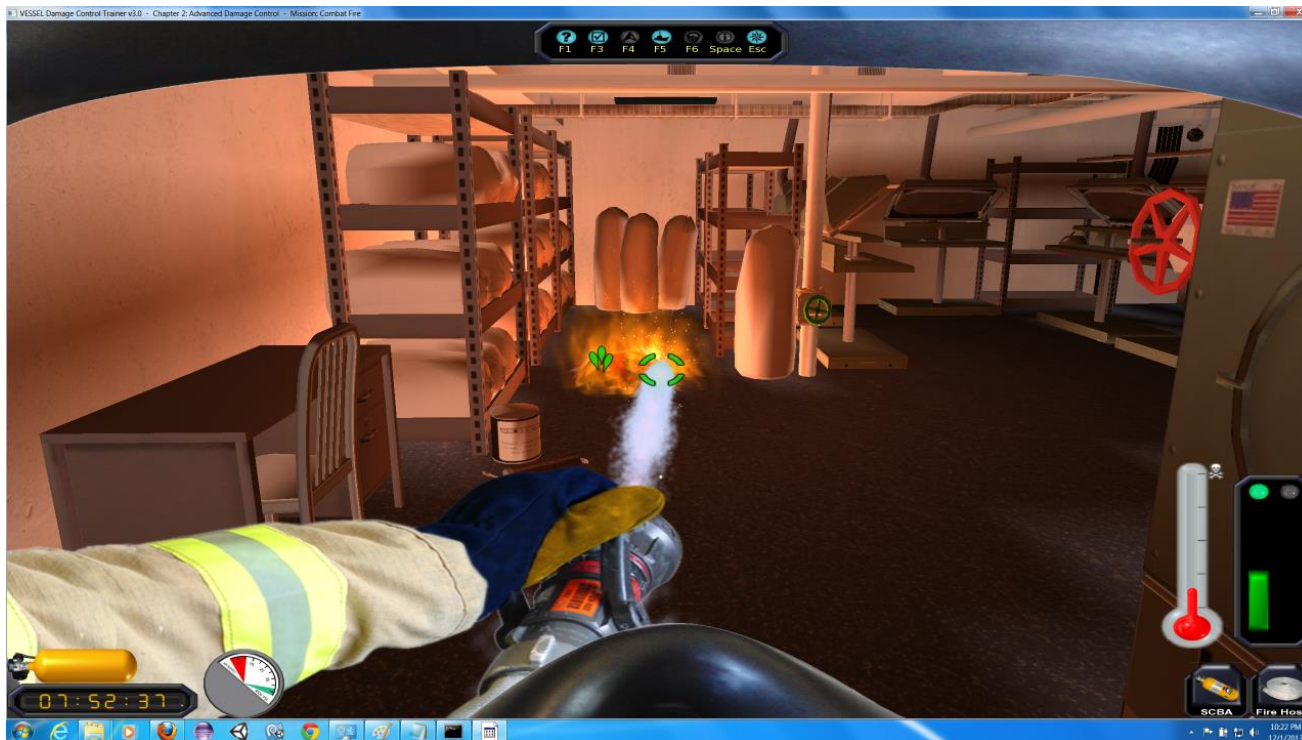 - Should you support competition or cooperation?

Break

8 minutes

Action Elements

- **Split into pairs in your group and determine the specific instructional situations and mechanics you will use to:** *5 minutes*
  - **Deliver Activities**
  - **Enable Actions**
  - **Create Drivers**
  - **Elicit Behaviors**

- **Regroup and discuss your choices. Revise for consistency.** *5 minutes*

→ **Report Out** *10 minutes total*

Please refer to your Action Elements and Design Patterns handouts

Action Elements

- **Action elements determine what learning activities the game puts the player in at different points in the game and what the player in turn can and should do in order to achieve their learning objectives.**
  - Emphasize the instructional basis for the activities and the level of authenticity of the actions in the game

- *Deliver Activities*:
  - What instructional activities will your game use to teach the player?
  - How will you introduce new knowledge, skills and abilities to the player?
  - Will you use different or additional activities for players that perform poorly?
  - How will the instructional technique be reflected in gameplay?

- *Enable Actions*:
  - What actions will your game allow the player to perform?
  - How will it convey those actions to the player?
  - How will the set of possible actions change as the game unfolds?
  - Do you need to constrain the possible actions based on player performance?

Action Elements

- *Create Drivers*:
  - What motivating drivers will your game use to encourage the player to take action?
  - Should you use time pressures or time-limited actions, and, if so, how do you ensure they support rather than interfere with learning?
  - Should you use a game economy, and, if so, what type of economy will support the learning objectives?

- *Elicit Behaviors*:
  - How will the game elicit the desired cognitive and/or procedural behaviors from the player?
  - Can you break down behavioral indicators into specific atomic actions under specific conditions?
  - Can a behavior only be demonstrated through a particular pattern of choices, and if so, what elements do you need to allow the student to show that pattern in the game?

Assessment Elements

- **Split into pairs in your group and determine the specific instructional situations and mechanics you will use to:** *5 minutes*
    - **Gather Data**
    - **Track Behaviors**
    - **Interpret Capabilities**
    - **Report Performance**

- **Regroup and discuss your choices. Revise for consistency.** *5 minutes*

→ **Report Out** *10 minutes total*

Please refer to your Assessment Elements and Design Patterns handouts

Assessment Elements

- **Assessment elements determine how the game and its supporting infrastructure measures the student's performance during the game against the learning objectives**
  - Inform how the instructional logic in the game should interact with the student as well as how the gameplay should unfold
  - Provide support for measuring learning outcomes when validating the effectiveness of the game
  - Focus on determining appropriate, measurable behavioral indicators that can be effectively embedded in the game

- *Gather Data*:
  - What player actions or internal states (e.g., cognitive, emotional) will you need to detect, infer, measure and/or store in order to assess player performance against the various learning objectives?
  - Will you collect performance data implicitly based on player actions, explicitly based on choices made during gameplay, or explicitly based on data obtained from or about the player?
  - What assessments are computed real-time, and what ones are computed after some amount of gameplay using collected data?
  - What infrastructure do you need to be able to capture the required data?
  - Do you need to capture data: at the "mouse-click" level, outside the game (e.g., survey, physiological measures), across gameplay sessions, about interactions among players or using human observers?

Assessment Elements

- *Track Behaviors*:
  - What behaviors do you focus on in different situations in the gameplay?
  - Do you need to collect different data depending on the player's prior context and performance?
  - What can be measured using an atomic player action?
  - What needs to be assessed based on a pattern of actions or interactions over time?
  - Do you need to assess the process being applied by the player, or just the outcomes of their choices?
  - How do you ensure that the measure is meaningful and valid when measured after guidance or feedback is given, or during replay?

- *Interpret Capabilities*:
  - How do you determine good or poor performance?
  - Can measures be compared to simple performance thresholds?
  - Is human interpretation of data essential for a valid interpretation?
  - How do you infer cognitive states reliably from actions taken in the game?
  - How do you interpret actions or patterns of actions?
  - What is a "good enough" measure for informing guidance and feedback?

- *Report Performance*:
  - How will your game report performance back to the player?
  - Does game performance need to be reported to an external system, such as a learning management system?
  - Will you provide an instructor interface that allows the instructor to access how the player is doing during or after the game?
  - Will you need to provide "instant replay" capabilities for reviewing performance?

Guidance Elements

- **Split into pairs in your group and determine the specific instructional situations and mechanics you will use to:** *5 minutes*
  - **Determine Need**
  - **Create Guidance**
  - **Deliver Guidance**
  - **Access Guidance**

- **Regroup and discuss your choices. Revise for consistency.** *5 minutes*

→ **Report Out** *10 minutes total*

Please refer to your Guidance Elements and Design Patterns handouts

Guidance Elements

- **Guidance elements provide information and direction to the player and ensure, in keeping with the instructional strategy, that they are aware of what they should be doing and how they should be performing.**
  - Certain types of guidance may be part of scaffolding and fade over time.
  - Pay careful attention to the effect of guidance on student performance and sense of flow.
  - In particular, balance the guidance so that poorly-performing players are not overwhelmed or penalized with harder gameplay compared to well-performing players.

- *Determine Need*:
  - What types of guidance should you provide based on the types of misconceptions players may form and errors they may make?
  - What guidance will you provide at the beginning of the game to influence how they approach the gameplay?
  - Will guidance in the game be based on performance or will the same guidance be provided to all players?
  - How frequently should you provide guidance to maximize instructional effectiveness while minimizing negative impact on gameplay?
  - How does the guidance change as gameplay proceeds and as scaffolding fades?

Guidance Elements

- *Create Guidance*:
  - How will you determine the content of the guidance to provide?
  - Will you determine the guidance statically in advance?
  - Will you dynamically generate guidance that takes into account previous guidance given?
  - Will you tailor guidance to the particular player?
  - How will you draw the player's attention to what they need to know in the game environment?
  - Will you vary guidance given during replay?

- *Deliver Guidance*:
  - What guidance is best provided using explicit delivery methods (e.g., via verbal suggestions or explicit graphical indicators)?
  - What guidance is best provided using implicit or indirect methods (e.g., via cues or hints)?
  - Should the guidance be provided within the game environment as part of the gameplay or provided using distinct user interface elements?
  - Will you need to deliver guidance on multiple things at the same time?

- *Access Guidance*:
  - Will players be able to request guidance or access guidance resources?
  - Once guidance is given, can it be retrieved later by the player or do they need to remember it?
  - How long should guidance remain visible to the player once provided?

Break

5 minutes
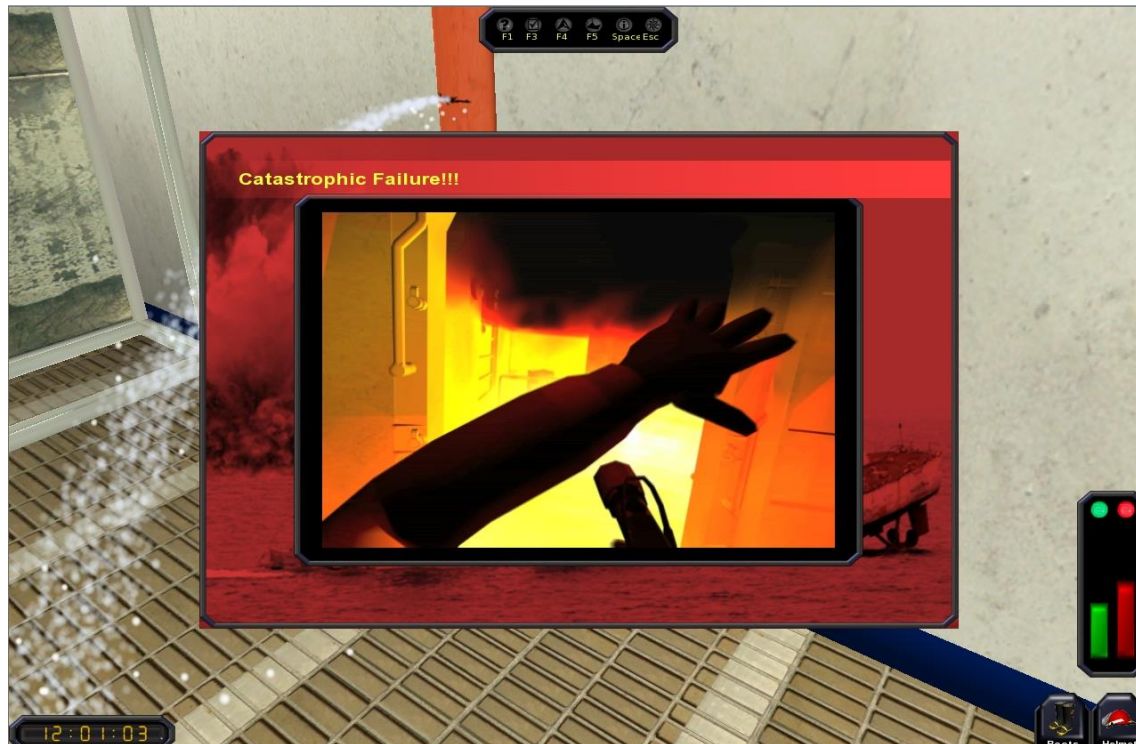
Feedback Elements

- **Split into pairs in your group and determine the specific instructional situations and mechanics you will use to:** *5 minutes*
  - **Determine Delivery**
  - **Give Rewards**
  - **Impose Consequences**
  - **Facilitate Reflection**

- **Regroup and discuss your choices. Revise for consistency.** *5 minutes*

→ **Report Out** *10 minutes total*

Please refer to your Feedback Elements and Design Patterns handouts

Feedback Elements

- **Feedback elements inform players about how they are performing in the game to ensure they**
  - Learn appropriately; Reflect accordingly on their performance; Are motivated to continue playing and learning; Maintain a sense of flow
  - Emphasis should be on creating feedback that focuses the player's attention on what they need to know to accomplish the learning objectives rather than distracting them with minor/irrelevant issues

- *Determine Delivery*:
  - When should you provide feedback to the player?
  - How do you ensure that the player associates the feedback with the actual behavior that led to it?
  - When is immediate feedback most effective?
  - Will the feedback disrupt the player's sense of flow?
  - What medium of delivery will have the greatest impact on the player's thinking and behavior?

- *Give Rewards*:
  - What good behaviors are suitable for giving the player a reward?
  - How can you avoid rewarding poor behavior? How are the rewards linked to the game drivers?
  - How can you provide a reward that feels natural within the context of the game?
  - What type of reward supports continued interest in the game?
  - How can you show players the positive impact of their good choices?

Feedback Elements

- *Impose Consequences*:
  - How do you make the game feel like a safe place to try and fail?
  - How do you penalize little errors versus big errors?
  - What makes a consequence feel substantial for the player?
  - Will the consequence be too far removed from the cause of the issue?
  - How can you provide a consequence that feels natural within the context of the game?
  - Should you scale back the severity of the consequences for poorer-performing players?

- *Facilitate Reflection*:
  - How do you ensure that the player reflects on the right connection between their behavior and the learning objective?
  - What types of rewards or consequences reinforce deeper reflection?
  - Will an earlier or later presentation of feedback be more likely to cause the type of reflection needed?
  - How explicit and/or detailed do you need to be to induce the right kind of reflection in the player?

Revise, Revise, Revise

Iterate

Core Design Phase
- Story Foundation
- Assessment Strategy
- Core Design
- Instructional Strategy
- Gaming Strategy

Analysis Phase
- Requirements Analysis
- Concept Formation
- Learning Objectives
- Domain Analysis
- Audience Analysis

Experience Design Phase
- Situation Design
- Architecture Design
- Experience Design
- Mechanic Design
- Asset Design

Testing Phase
- Playtesting
- Outcome Validation
- Formative Feedback
- Software Testing
- Usability Testing

Development Phase
- Content Development
- Environment Integration
- Prototype/Product
- Front-End Development
- Back-End Development

Customer/SME Feedback

We are here

Revise/Harden

Preliminary, Alpha, Beta, Candidate Release

- **Prototype**

- **Iterate**

- **Playtest**

- **Revisit assumptions often**

- **Do a mental walkthrough of the game – From the player's perspective**

- **Pretend you're playing the game and identify issues that come to mind *10 minutes***
  - Think edge-cases – poor performers, "gaming the game", bored players
  - Think devil's advocate – what breaks immersion, flow, buy-in

- **Pick one part of the game (e.g., the "worst" issue found in Exercise 13) and discuss how to tune it** *10 minutes*
  - e.g., For a "level" (or part of game encompassing multiple situations):
    - Are we teaching too much in this level? Are we teaching enough in this level? What should we simplify or add? Do we need to change the set of learning objectives for this level?
  - e.g., For an instructional situation:
    - Is this situation properly focused on its learning objectives? Have we captured the appropriate correct and incorrect behaviors? Do we need additional guidance or feedback?
  - e.g. For an instructional mechanic:
    - Is the interaction easy to understand? Does it give too much away? Is the interaction authentic? Too "wordy"? Too clunky?

→ **Report Out (for 13 & 14)** *10 minutes total*

Exercise #15: Real Life Intervenes

- **Each group discusses one of the below issues (assigned by facilitator)**

- **Focus on answering 2 questions: What do you Keep? What do you Change? *5 minutes***
  1. **Customer doesn't think it is fun**
  2. **Customer wants to go deeper "here"**
  3. **Students don't like it**
  4. **It isn't producing desired learning outcomes**
  5. **Money has been cut in half**
  6. **It takes too long to play**
  7. **The players are gaming it and not taking it seriously**

→ Report Out *10 minutes total*

What did we learn?

Recap: Learning Objectives

- **Apply iterative methods for designing a learning game**

- **Apply methods to blend gaming and learning in the story, goals, instruction and gameplay of a serious game**

- **Perform the basic tasks involved when starting a serious game design effort**

- **Work effectively with other disciplines to design a serious game for learning**

- **Value the use of design patterns in your approach**

- **Design instructional mechanics and situations that apply your instructional techniques and support your gameplay**

- **Review and revise your design**

Recap: Workshop Flow

- ✓ **What's involved in creating a serious game for learning?**
  - ✓ **Team building exercise**
- ✓ **Analysis**
  - ✓ **Exercise 1: What are our requirements, domain and audience?**
  - ✓ **Exercise 2: What's our game concept?**

    <Break>
  - ✓ **Exercise 3: What are our learning objectives? What are we assessing?**
- ✓ **Core Design**
  - ✓ **Exercise 4: What's our story?**

    <Break>
  - ✓ **Exercise 5: How are we teaching?**

  - ✓ **Exercise 6a: What's our gameplay?**

    <Where's our Lunch?>
  - ✓ **Exercise 6b: What shouldn't be in our game?**

- ✓ **Experience Design**
  - ✓ **Exercise 7: Goal elements**
  - ✓ **Exercise 8: Control elements**

    <Break, Book Raffle>
  - ✓ **Exercise 9: Action elements**
  - ✓ **Exercise 10: Assessment elements**
  - ✓ **Exercise 11: Guidance elements**

    <Break>
  - ✓ **Exercise 12: Feedback elements**
- ✓ **Revise, revise, revise**
  - ✓ **Exercise 13: In the player's shoes**
  - ✓ **Exercise 14: Tuning**
  - ✓ **Exercise 15: Real-life intervenes**
- • **What did we learn?**
  - – **Recap exercise**

- **Top things learned today**

- **Top challenges - revisited**

- **Each group member says the main thing they have learned today. You have *5 Minutes* total.**

  - **No repeats**

  - **If you have changed your view on your top perceived challenge in serious game design/development, then update it.**

Thanks!!

- **Kishan Shetty** kishan.shetty@janusresearch.com

- **Peter Smith,** peter.smith@ucf.edu

- **Stu Armstrong,** stu.armstrong@cesicorp.com

- **Get the book:**
  - http://www.amazon.com/Design-Development-Training-Games-Multidisciplinary/dp/1107051746/

Design Patterns and Reference Slides

Goal Patterns

Pattern Name	Type	Description	Instructional Intent	Gaming Intent
Quest	IS	Provide a long-term goal that the player must achieve by accomplishing a number of intermediate sub-goals.	Provide an experiential situation in which the player is given an explicit goal that requires achieving the high-level learning objective(s)	Provide a sense of adventure within a strong story context
Mission	IS	Provide a limited set of goals for the player to accomplish within a particular context that has a clear beginning and desired end state	Provide the opportunity to learn and demonstrate a set of related enabling objectives within a particular context.	Provide a specific challenge that requires careful consideration to achieve success and avoid failure.
Turn	IS	Provide the opportunity for the player to build upon prior choices in pursuit of a set of goals	Provide repeated opportunity for the player to perform key activities in an evolving context after viewing the outcomes of previous choices in those activities.	Player has some freedom to choose what to focus on in a given turn.
Assigned task	IS	Provide a specific challenge to achieve in the game which will demonstrate progress towards achieving one or more learning objectives.	Completing the task demonstrates evidence of learning. Errors or inefficiencies in performing the task indicate potential issues and teaching opportunities.	Provide an engaging task for the player to perform to gain a sense of accomplishment.
Pop-up Task	IS	Reveal a new task to accomplish while the player was trying to accomplish another task.	Emphasize the need to be aware of and responsive to changes in the situation.	Indicate how the gameplay is unfolding
Cut-scene	IM	Expository scene viewed immediately prior to starting a mission or turn	Introduce the learning objectives for the next portion of gameplay.	Provide an update to the unfolding narrative and motivate continued gameplay
Briefing	IM	Provide an interaction in the game that reveals the next set of things to accomplish	Introduce the learning objectives for the next portion of gameplay.	Provide an update to the unfolding narrative and motivate continued gameplay

@IITSEC   NTSAToday

Goal Patterns cont.

Pattern Name	Type	Description	Instructional Intent	Gaming Intent
Goal selector	IM	Enable the player to select among multiple choices to determine the specific goals to focus on in the next portion of gameplay.	Facilitate exploratory learning	Allow the player to choose their own path to winning the game.
Introductory scene	IM	Introductory expository scene viewed when the player first starts the game	Introduce context within which learning within the game will occur. Motivate and clarify the purpose of the learning. Prime the student on how to approach the learning.	Introduce backstory, characters and basic gameplay motivation.
Tutorial Level	IS	Interactive tutorial that walks the player through a small set of actions to achieve a known end-state	Introduce initial learning objectives and model correct behaviors	Teach player how to use the basic mechanics of the game and what the rules of the game are.
Supplementary Activities	IS	Set of preparatory and follow-up activities the player must perform before and/or after each gameplay session. E.g., in-person briefing or debriefing.	Review knowledge and skills required to perform in the game and explicitly connect learning with the real-world context.	Encourage continued interest in the game while minimizing elements that detract and distract from gameplay in the game itself.
On-demand Objectives List	IM	Provide the player with a list of objectives for the current gameplay level	Summary of learning objectives to focus attention and reduce memory load.	Let player know what they need to be able to do to pass the level
Time Limit	IM	Provide a continual indication of the time remaining to complete the current activity	Reinforce the need to act promptly.	Impart a sense of challenge and urgency to facilitate sense of flow.
Goal HUD	IM	Show game goals as icons on the screen reflecting what has been done and what remains to be done	Continual reminder of objectives and summary of achievements	Provide player with immediate feedback on successes as gameplay unfolds and reminders of remaining challenges.

Goal Patterns cont.

Pattern Name	Type	Description	Instructional Intent	Gaming Intent
Exploration constraint	IM	Provide an explicit limitation on the player's ability to explore freely	Focus player's attention	Speed up gameplay, particularly in earlier levels.
Pop-up reminder	IM	Provide an explicit reminder of the player's current goal to keep them on track.	Focus player's attention	Speed up gameplay, particularly in earlier levels
Reminder cue	IM	Provide an implicit reminder in the game environment of the player's current goal to keep them on track	Focus player's attention	Speed up gameplay, particularly in earlier levels, while maintaining sense of immersion.
Level progress meter	IM	Single dimension indicator of progress in the current game activity	Show cumulative progress towards the completion of all learning objectives.	Provide indicator of how much gameplay remains.
Multi-goal progress meter	IM	Multi-dimension indicator of progress in the current game activity	Independently show incremental progress towards the completion of several key learning objectives	Reinforce the need to play against multiple dimensions at once.
Task completion list	IM	Explicit summary of what has been completed so far in the current game activity	Ensure player knows they do not have to continue performing a completed task.	Reinforce good gameplay and recognize achievement
Achievement tracker	IM	Summary of what the player has accomplished so far in the current game activity	Reward demonstrated evidence of achieving a learning objective.	Reinforce good gameplay and recognize achievement

Control Patterns

Pattern Name	Type	Description	Instructional Intent	Gaming Intent
Manipulate help resources	IM	Change the information available in help resources to only what is needed in the current context	Minimize extraneous information	Keep it simple
Challenge level selector	IM	Allow the player to select level of difficulty of gameplay	Engage students of multiple expertise levels and provide opportunities for continued play and practice.	Keep the game fun
Scripted flow	IS	Fixed sequencing of gameplay regardless of player choices	Enforce a consistent learning experience on all students	Usually not a good gaming approach, but useful for earlier levels to avoid overwhelming players.
User choice flow	IS	Allow user to select the next game activity to perform (e.g., level selector, choose door to enter)	Support exploratory learning	Allow player high sense of agency
Cause/effect flow	IS	As players perform actions in the game, new opportunities are revealed	Performance-based sequencing as players demonstrate acquisition of prerequisite enabling objectives.	Reinforce sense of adventure and agency.
Randomized levels	IS	Allow repeated playing of a given level with each experience being different enough to remain challenging	Support practice and safe failure for increased time on task	Keep the game interesting and dynamic
Continuation	IS	Allow player to continue in the game from where they left off previously	Support continued time on task	Maintain sense of accomplishment (and avoid tedium of repeating known activities)

Action Patterns

Pattern Name	Type	Description	Instructional Intent	Gaming Intent
Practice session	IS	Provide a distinct gameplay experience in which the player is able to try out different ways of achieving a goal without negatively impacting other gameplay outcomes.	Provide a practice opportunity to improve performance on a specific learning objective with fewer distractions than in normal gameplay.	Encourage continued gameplay in the face of poor performance or failure.
Puzzle exercise	IS	Provide the player with a goal to achieve and clues on the steps to achieve it, but no direct answers on the right solution.	Support inference skills.	Provide challenges to be surmounted through intuition and ingenuity.
Revealed action	IM	Cues in environment reveal the ability to perform a new action	Reinforce paying attention and using what is at hand	Demonstrate ability to think outside the box and be innovative
Affordance action	IM	Reveal to the player what types of actions are available to them when using or affecting an object in the game	Reinforce what actions can be performed within a given context	Reinforce skill of taking advantage of what is in the game environment. Minimize need for complex tutorials and retain sense of having new things be possible.
Time limited actions	IM	Capability provided to player for a limited time in game	Reinforce that resources are limited and consequences of not paying attention to those limits	Increase challenge and encourage active planning on how to best use the action.
Local actions	IM	Capability provided to the player in a specific context in the game	Only allow context-relevant actions	Support modal gameplay
Earned actions	IM	New capabilities that are "unlocked" as the player achieves goals in the game	Fade away scaffolding that made earlier problems easier to solve	Reward good play through accumulation of capabilities and encourage sense of power

Action Patterns cont.

Pattern Name	Type	Description	Instructional Intent	Gaming Intent
Search for clues	IS	Mechanics that allow the player to physically inspect within and around objects in the environment to detect cues and discover information.	Encourage active discovery learning through realistic actions.	Provide sense of challenge and curiosity.
Challenge pre-conceptions	IS	Provide players with a particular initial impression of the game world, current situation and current goals. Then challenge them by providing surprising and conflicting information and events during subsequent game play.	Train meta-cognitive capabilities and broaden earlier learning to novel contexts. Correcting actual real-life pre-conceptions that are faulty.	Provide high sense of adventure.
Apply a procedure	IM	Set of mechanics that allow the player to perform all steps of a procedure using realistic actions.	Demonstrate application of skills with potential ordering errors, missing steps and incorrect added steps	Follow the right set of steps to accomplish a goal..
Action-based HUD	IM	Icons on the heads-up display, usually around the edge, that can be clicked on to apply a corresponding action	Minimize memory load	Keep interface simple
Apply tool	IM	Provide player with the ability to use a particular tool to perform the appropriate action in the game.	Reinforce use of real tools in appropriate contexts using sufficient authenticity.	Solve the problem using the right tool in the right way at the right time.
Interact physically	IM	Set of mechanics that allow the player to physically manipulate or affect objects and characters in the game.	Reinforce cause and effects of physical interactions under different contexts.	Support natural interactions within the environment.
Conversation tree	IM	Communication mechanic that provides a branching dialog between the character and a non-player character, where different player statements lead to different NPC responses, as appropriate.	Provide choices based on learning objectives for the player to select among. Demonstrate appropriate communication protocols or social skills	Provide engaging interactions with game characters.

Assessment Patterns

Pattern Name	Type	Description	Instructional Intent	Gaming Intent
Success requires understanding	IS	Constrain the situation flow and the player actions so that there is no way for the player to succeed except by understanding what you are trying to teach them	Avoid negative training	Avoid gaming the game
Inferred behaviors	IM	Explicit choice to infer desired behavior from specific action taken in specific contexts	Provide reasonable assessment of progress against learning objectives..	Keep the gameplay natural
Common error detection	IS	Include choices in the game (distractors) that indicate common misconceptions	Provide reasonable assessment of misconceptions	Give the player enough rope to get into trouble.
Validating follow-up action	IM	Use a canned dialog following a task to check their level of understanding of what they just did	Explicit confirmation of player's reasoning	Usually not a good game approach, but appropriate if put in game context, such as reporting up to the boss.
Query to confirm understanding	IM	Provide a set of open-ended follow-up questions to capture the player's thinking about their actions	Enable human expert assessment for accurate results	Often breaks the immersion of the game, but can be tied to an external real-world activity or driver (such as a grade)

Guidance Patterns

Pattern Name	Type	Description	Instructional Intent	Gaming Intent
Embedded information	IM	Enable the student to examine objects in the environment and receive information about those objects and how to use them (mouse-over, inspect).	Minimize distractions and memory load	Keep the interface simple and allow expert players to play quickly without interference
Advance hints	IM	Provide students with suggestions on how to achieve learning goals prior to start of game or game level	Prime player on correct approach	Give player sense of having privileged knowledge that gives them a leg up
Pop-up reminder	IM	Pop up a reminder on what they need to accomplish next as well as how to perform more effectively.	Performance based guidance to keep learner on track and efficient	Provide clear indication that player is missing something without giving away the answer
In-dialog guidance	IM	Provide the student with suggestions or detailed information using an natural in-game context	Performance based guidance to keep learner on track and efficient	Provide clear indication that player is missing something without giving away the answer
Explicit instructions	IM	Explicitly define the details of a procedure to the student prior to performing a task involving that procedure.	Ensure student has required supporting knowledge	Learn the rules of the game to win
Cues/Hints	IM	Provide cues in the environment or hints from characters that give partial information in service of achieving the current learning objectives	Promote thinking, extrapolation and reflection on part of student	Encourage a sense of adventure and discovery
Visual Aid	IM	Provide in-game visual aids to assist in understanding the task/environment	Minimize memory load	Keep interface simple and embed tutorial-like guidance in the game
On-demand didactic reference	IM	Provide students with access to written and visual explanations of different aspects of the topic, procedures and cognitive skills being taught	Ensure students have supporting knowledge and minimize cognitive load for poorer performers	Provide just-in-time information to keep the game simple and streamlined

Feedback Patterns

Pattern Name	Type	Description	Instructional Intent	Gaming Intent
Flash feedback	IM	Provide a quick presentation of an iconic explanation for a good or poor decision	Provide immediate feedback that can be clearly associated with the causal action	Iconic feedback that can be quickly grasped without impacting sense of flow
Demerit with feedback	IM	Provide a penalty directly in response to an error while clearly indicating what led to the error and how to improve in the future.	Provide feedback on an error made to encourage reflection and provide guidance on correct behavior	Penalize poor gameplay while maintaining sense of flow
Catastrophic failure	IM	When a critical error is made, immediately fail the current level.	Teach the student that the behavior that caused the catastrophic event is not acceptable in any way – used for critical errors.	Increase tension by introducing the risk of "sudden death".
Score	IM	A numerical value representing achievement in the game.	Provide a measure by which students can objectively assess their positive accomplishments towards learning objectives	Motivate player by rewarding good gameplay and penalizing poor gameplay.
Game Rating	IM	Provide players with a rating on a fixed scale that reflects their performance level.	Reinforce the importance of performing to an acceptable standard	Driver to motivate the player to excel
Strike	IM	Provide the player with a limited number of chances, and each key error made uses up one of those chances. The player fails when no chances are left.	Convey the importance of a specific type of error, without forcing replay after each try.	Build tension as the number of strikes the player has accrued increases
Progress constraint	IM	After players make a key error, don't let them proceed in the gameplay until they have clearly demonstrated the ability to perform the task(s) correctly.	Enforce instructional sequencing and appropriate mental models.	Players must learn to play correctly in order to succeed.

Feedback Patterns cont.

Pattern Name	Type	Description	Instructional Intent	Gaming Intent
Cumulative performance bars	IM	Provide a visual object on the game HUD that changes as the player makes good (or bad) choices to reflect better (or worse) performance..	Immediate implicit feedback on performance. E.g., Merit bar increases as tasks are completed; Demerit bar increases as errors are made.	Reward good gameplay and provide indicator of what's left to finish the current game activity
Continual performance summary	IM	Provide a constantly visible indicator of the player's performance on the screen.	Provide dynamic feedback on performance against all learning objectives.	Reward good gameplay and keep players aware of how they are doing at all times.
Natural consequences	IM	Upon making an error, the player experiences the natural outcome of that action in the game	Demonstrate consequences of an error without ending gameplay and implicitly show why performing correctly was important.	Maintain sense of agency and flow. Reinforce game drivers
Interrupting feedback	IM	Stop the gameplay to provide specific feedback on an action the player just took.	Alert student to performance above or below expectations and ensure student receives feedback in timely manner.	Provide immediate recognition and gratification
Performance recap	IM	Provide a final summary of the player's performance against all learning objectives at the end of the level or game.	Explicitly summarize strengths and weakness of the student's performance	Let players easily see what they did well on and where they need to improve their gameplay.
Debrief/ After-Action Review	IS	At the end of the level, provide players with the ability to interact with each other and/or an instructor to discuss what happened during the level and how to improve.	Provide reflection/feedback opportunity.	Motivate replay/continuing play. Give sense of progress.

- **Balance between timeliness, level of detail & style**

- **Should encourage reflection**

- **Choices about HOW you give feedback have significant impact on perception of flow.**
  - **Ideally, feedback stays in the story**
  - **Consequences – natural vs. direct, recoverable vs. catastrophic**
  - **Verbal feedback – align content with gaming context, don't disrupt experience**
  - **Indirect feedback (e.g., score) may be too obscure to encourage reflection. Make it clear why the score is what it is.**
  - **** Feedback may be critical to maintain flow if the student experiences difficulties in learning**

- **Helps learners call forth correct prior knowledge**
  - **Activates prior knowledge**
  - **Compensates for missing prior knowledge**
  - **Minimizes triggering of irrelevant prior knowledge**

- **Use the introduction of the story and game goals to prime learners**
  - **A pre-mission brief**
  - **An anecdote communicated by a character in the game**
  - **A cut-scene to introduce relevant content and context**
  - **Environmental cues**

- **Be careful of distracting or "seductive details"**

Guided Practice Elements: Scaffolding

- **Memory aids**
  - "What am I supposed to do?"

- **Help resources**
  - Avoid "crutches" that can allow a student to complete play without actually making choices that lead to learning.
    - "Don't give away the answer"
    - Make it available only when needed to help, not all the time.
  - Provide access to pre-requisite knowledge to avoid assumptions about the student's state of knowledge

- **Modeling**
  - What happens in your virtual world around the student will influence the student.
  - Make it count by modeling correct behaviors (or highlighting incorrect behaviors)
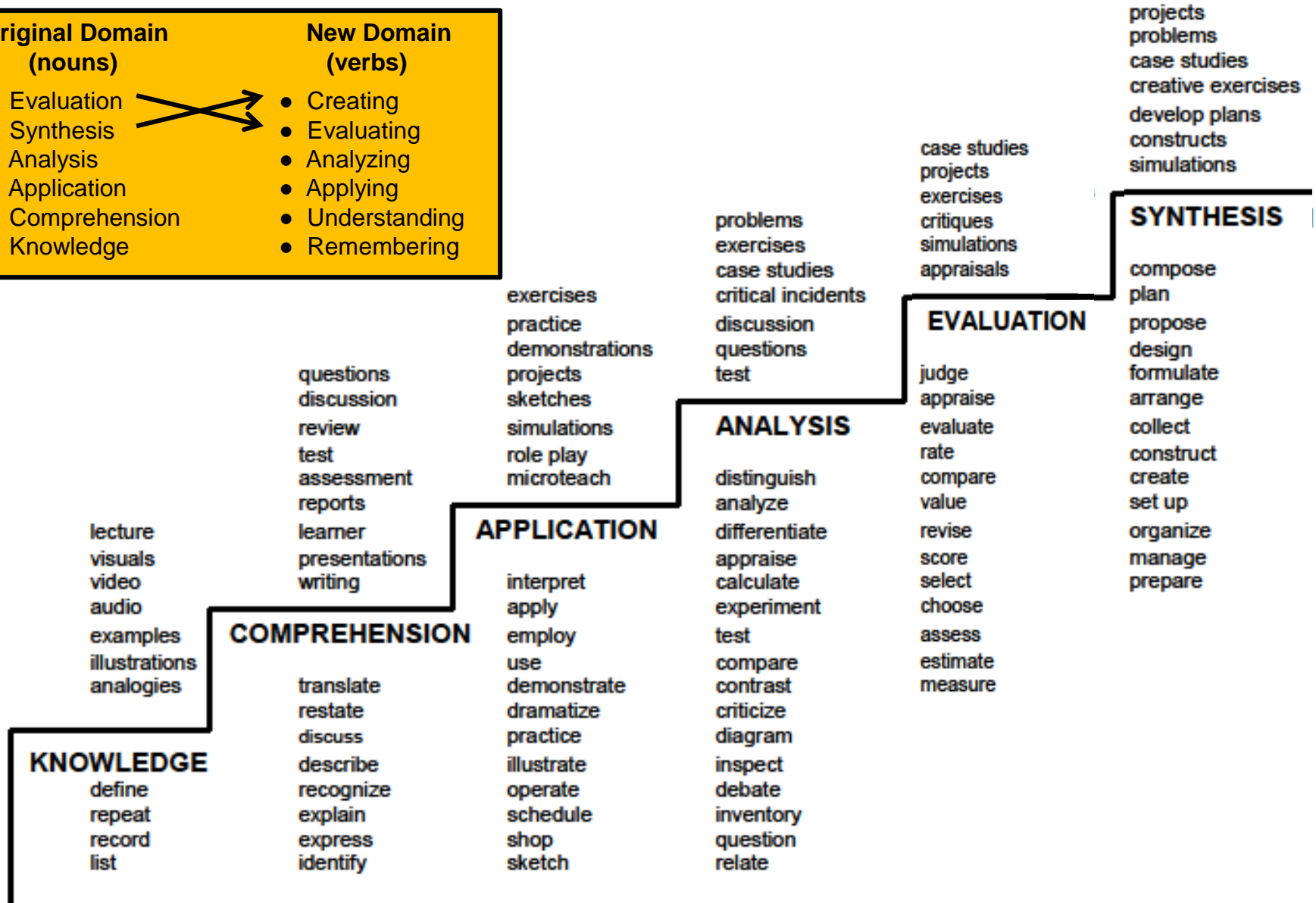
Bloom's Taxonomy & Instructional Strategies

Original Domain (nouns)	New Domain (verbs)
• Evaluation	• Creating
• Synthesis	• Evaluating
• Analysis	• Analyzing
• Application	• Applying
• Comprehension	• Understanding
• Knowledge	• Remembering

SYNTHESIS

projects
problems
case studies
creative exercises
develop plans
constructs
simulations

compose
plan
propose
design
formulate
arrange
collect
construct
create
set up
organize
manage
prepare

EVALUATION

case studies
projects
exercises
critiques
simulations
appraisals

judge
appraise
evaluate
rate
compare
value
revise
score
select
choose
assess
estimate
measure

ANALYSIS

problems
exercises
case studies
critical incidents
discussion
questions
test

distinguish
analyze
differentiate
appraise
calculate
experiment
test
compare
contrast
criticize
diagram
inspect
debate
inventory
question
relate

APPLICATION

exercises
practice
demonstrations
projects
sketches
simulations
role play
microteach

interpret
apply
employ
use
demonstrate
dramatize
practice
illustrate
operate
schedule
shop
sketch

COMPREHENSION

questions
discussion
review
test
assessment
reports
learner
presentations
writing

translate
restate
discuss
describe
recognize
explain
express
identify

KNOWLEDGE

lecture
visuals
video
audio
examples
illustrations
analogies

define
repeat
record
list