Serious Game Design Tutorial

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PICK A ROLE THAT MOST CLOSELY MATCHES YOUR EXPERIENCE

A. Instruction – e.g., Instructional system 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

FORM GROUPS WITH A MIX OF EACH ROLE

Objectives
After this tutorial, you will be able to ...

- Explain the motivation for blending engagement and learning elements when designing a serious game

- Apply methods to blend engagement 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

- Design instructional mechanics that apply your instructional techniques and support your gameplay.

Tutorial Flow

- What's involved in creating a serious game for learning?
  - Team building exercise
- Let's design a game together (via group exercises)
  - Exercise 1: What are our requirements?
  - Exercise 2: What are our learning objectives?
  - Exercise 3: Who is in our game? Where does it happen? What's up?
  - Exercise 4: How are we teaching?
  - Exercise 5: What's our gameplay?
  - Exercise 6: What are our instructional mechanics?
- Bringing it all together
  - Wrap-up exercise

Rules of Engagement

- Group exercises will largely be brainstorming exercises
- All ideas are valuable. Note down all ideas first and filter afterwards.
- Assign a scribe for each exercise. Rotate scribes to share the load.
- Rotate group leaders (if you choose to have one) to keep things dynamic and ensure all viewpoints are heard.
  - Group leader should keep an eye on the time and keep things moving
  - Group leader should report out to larger audience at end of exercise
- We're here to learn, but let's all throw some fun in
- Raise hand to ask questions during exercises.

What's involved

- Games lend themselves naturally to several types of instruction
  - Scenario-based, guided practice (This is what we're focused on today)
  - Exploratory learning with after-action review
  - High-fidelity, part-task training
  - Interactive problem-solving with feedback
- Requires a Multi-Disciplinary Effort
  - Instructional system 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
- Key design/development tasks
  1. Identify requirements, task analysis and learning objectives
  2. Determine instructional approach
  3. Design game concept and supporting story
  4. Design gaming elements and instructional elements
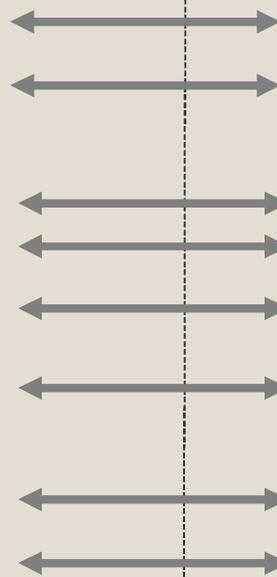 5. Test game (play-testing, usability, learning effectiveness)

Iterative or agile

What are we trying to blend?

Engagement
- Fantasy, Imagination
- Interesting (suspension of disbelief)
- Challenging
- Compelling (Senses)
- Immersive
- Motivating (keep playing, intrinsic)
- Flow
- Story

→ Entertainment ("Fun")

Learning
- Cognition, Behaviors
- Relevant, Appropriate
- Target Expertise Level
- Authentic
- Time-on-task
- Motivating (keep learning, extrinsic aspects)
- Learning Continuum
- Context

→ Self-improvement, Mental models, Learning outcomes

How do we achieve the blend?

- Make every design decision taking both engagement and learning into account

- Keep It Simple

Makes sense, but why?

- Cognitive Load & Authenticity
  - Avoid Extraneous. Keep it Germane.
  - 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
  - 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

Team Building Exercise

- Meet & greet
- Top X challenges (X = group size)

- 5 Minutes

- Each member of group
  - Briefly discuss who you are and what your background is
  - Document the top 1 challenge you see in serious game design and development -- no repeats. (scribe on pad)

REQUIREMENTS

Target Domain

- Small Unit/Team Tactics
  - Leadership
  - Planning
  - Communications
  - Execution
  - Adaptability

- Let's pick

  (show of hands)

  - Air, Ground or Sea

Let's pick:

A
- Team trainer (multi-player)
- Practice environment prior to first deployment
  - After classroom training and prior to live training

or

B
- Individual Trainer (single player)
- Learning environment for new small unit/team leaders
  - Experienced as team member, limited experience as team leader

Exercise #1
What are our requirements?

1. Top 2 Deployment constraints
2. Top 2 Characteristics of students
3. Top 2 Issues to address
4. Top 2 Desired outcomes
5. Top 2 Current training methods and their key weakness
6. Top 1 Anecdote that illustrates a typical error made by students …and appropriate solution

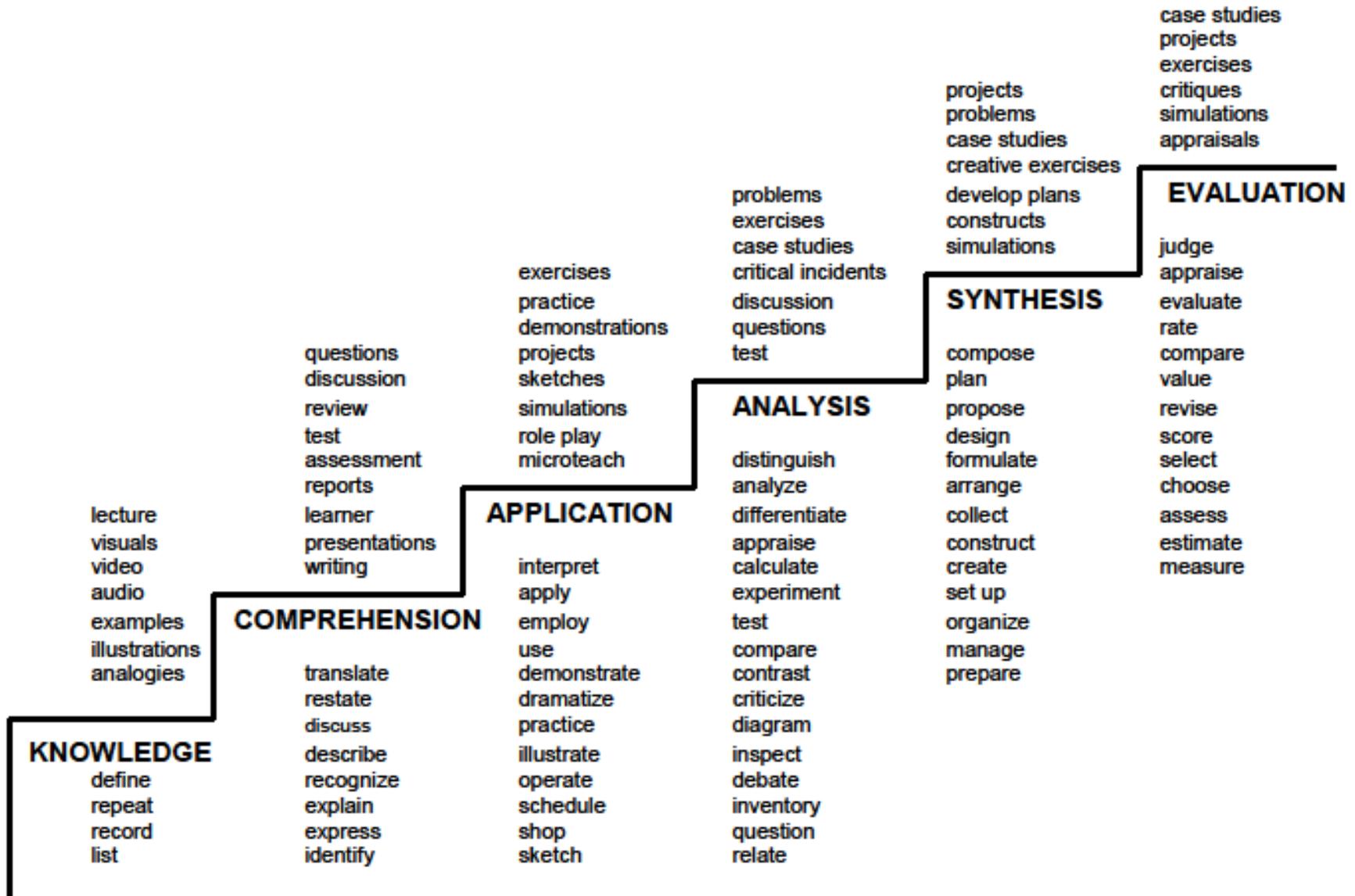- 5 minutes – Discuss only one of the above in your group (scribe final results on pad)

LEARNING OBJECTIVES

A Good Learning Objective

- Outcome statement that captures specifically what knowledge, skills, attitudes *learners* should be able to exhibit following instruction. They should be "***SMART***"

  - *S*pecific
  - *M*easurable/Observable
  - *A*ttainable for target audience within scheduled time and specified conditions
  - *R*elevant and results-oriented
  - *T*argeted to the learner and to the desired level of learning

- Key questions: Is a game the right medium for the learning objective? Can you elicit the relevant behaviors in a game?

Suggested Instructional Strategies for Use with Each Level of Bloom's Taxonomy

EVALUATION

case studies
projects
exercises
critiques
simulations
appraisals

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

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

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

- From ftp://ftp-fc.sc.egov.usda.gov/NEDC/isd/taxonomy.pdf

What about Gaming Goals?

- A learning objective is not a gaming goal per se
  - But it often can be if aligned correctly
  - Wording of goal presented to student may differ from ISD specification of learning objective
- A good set of explicit goals motivates the player
- What about implicit goals?
  - Need to support reflection by the student
- Design of goals hinges strongly on the type of targeted student (novice/expert, compulsory/voluntary, interested/disinterested)
- Influences and influenced by story

Exercise # 2
What are our Learning Objectives

- Examples:
  - List the roles and responsibilities involved in a tactical team
  - Explain the importance of monitoring teammates during an operation
  - Communicate changes in the plan to the team in a timely manner

- 5 minutes – Identify 2 learning objectives your group feels are most important for our game (scribe on pad)

STORY

Story

- Story Elements
  - Characters, Setting, Voice, Plot, Conflict, Theme
  - Theme → The lesson/message, which should align with the learning objectives
- Provide interesting, meaningful context for the learning objectives
  - Keep it relevant and not too complex or may increase extraneous load
- As the story in the game unfolds, it should capture the progression of instruction (i.e., plot embeds instructional sequencing)
- Early brainstorming on the unfolding narrative for teaching certain learning objectives can really focus priorities and involve SMEs
- Story choices can drive development of a lot of "color" – interesting character backgrounds, appealing settings
- Story choices also drive motivating factors – solve the mystery, go on a quest, beat the enemy, save the prince

Exercise # 3
What's our story?

1. **Develop a character (3+ groups)**
   - Gender, physical characteristics, background, goals and motivation, personal life, work/military life, quirks, relationships, etc.

2. **Develop the world (max 2 groups)**
   - What is going on in our (game) world? Where are we? Describe the location – local people, buildings, equipment, etc.

3. **Create a situation (max 2 groups)**
   - What has just happened and what is our team about to do? What are the key relevant facts, issues?

4. **Create a story arc (max 2 groups)**
   - What happens at the beginning, middle, end? Align with learning objectives.

- 10 Minutes – Pick one of the above and develop it in your group (scribe all details on pad)

INSTRUCTION

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
  - Use of priming
  - Feedback techniques
  - Use of scaffolding
  - Supporting materials

Feedback

- Balance between timeliness, level of detail & style
- Should encourage reflection
- Choices about HOW you give feedback have significant impact on perception of flow.
  - 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

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).

Exercise #4
Designing our instruction

- Choose 1 learning objective
  - How do you want to teach 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 students to avoid?
  - What is an example of good performance?
  - (if team trainer) How will different players be differentiated in their roles in the game?

- 10 Minutes – Answer as many of the above as you can (scribe details on pad)

GAME

Gameplay

- Games are all about interactions
  - These interactions must align with learning objectives and not distract
  - Player interacting with objects, with characters, with other students, with UI
- 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
- Common conflicts within the design team
  - "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

Exercise #5
Gaming Elements

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

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

3. **What does the game do to the player?**
   - e.g., increase challenge, add enemies, change the situation

4. **What wins the game and what loses the game?**

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

- 10 minutes: Pick one. Design a solution (scribe details on pad). *** Keep in mind how it aligns with the instruction*

BRINGING IT ALL TOGETHER

Instruction in a 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 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.

Goal Mechanics

Mechanic	Instructional Purpose
Direct command from NPC	Provide a change in tasking in a manner consistent with the learning context.
Current objectives list	Provide students with explicit information about the learning/game objectives they should be pursuing and which objectives they have achieved.
Cumulative Score	Provide students with a clear performance metric.
Countdown clock	Impart urgency to reinforce the importance of timely actions
Explicit Task List	Provide feedback on tasks accomplished and guidance on tasks remaining to be performed.
List of priorities	Provide guidance on relative importance of available choices
Task completion message	Provide immediate feedback upon completion of a goal
NPC 'friendly' meter	Reinforce the importance of maintaining awareness of the consequence of actions on the perceptions of others.

Story Mechanics

Mechanic	Instructional Purpose
Introductory scene or description of setting	Introduce context within which learning within the game will occur. Motivate and clarify the purpose of the learning.
Introduction to a level/mission	Provide specific context for an upcoming experience. Provide guidance on tasks and objectives.
End of level experience summary	Provide reflection/feedback opportunity. Motivate replay or continuing play for ongoing learning. Provide sense of progress.
Cut-scene	Provide context for a change in the situation and/or model a desired action or process. Provide reward for good performance.
NPCs that can be queried	Provide guidance on tasking or changes in tasking. Motivate the importance of interpersonal skills in solving problems.
NPCs in trouble	Motivate the potential consequences to others of your actions.
Narration/Voice-Over	Provide feedback on progress and priming for upcoming events.
Sound-effects/Music	Reinforce the importance of an upcoming choice or action taken.

Guidance Mechanics

Mechanic	Instructional Purpose
Embedded information	Enable the student to examine objects in the environment and receive information about those objects and how to use them (mouse-over, inspect).
Advance priming	Provide students with directions and a summary of learning goals prior to start of game (or game level)
Current objectives list	Provide students with explicit information about the learning/game objectives they should be pursuing and which objectives they have achieved.
In-dialog hints	Provide the student with suggestions or detailed information
Explicit instructions	Explicitly define the details of a procedure to the student prior to performing a task involving that procedure.
Cues/Questions	Promote thinking and reflection on part of student
Visual Aid	Provide in-game visual aids to assist in understanding the task/environment
Didactic reference	Provide students with access to written and visual explanations of different aspects of the topic, procedures and cognitive skills being taught

Interaction Mechanics

Mechanic	Instructional Purpose
Document a plan	Encourage analysis and synthesis by the student.
Execute a plan	Encourage application and comprehension by the student
Search for clues	Ensure students explore options and undergo discovery learning
Apply a procedure	Demonstrate application of skills with potential ordering errors, missing steps and incorrect added steps
Question an individual	Encourage analysis and evaluation by the student, potentially also training specific interpersonal skills (negotiation, cultural, HUMINT)
Follow a set of orders	Encourage application, but also analysis and evaluation when there are difficulties encountered that impact orders
Execute a mission	Provide realistic context reflecting real-world context and methods
Apply equipment, etc	Demonstrate comprehension of safety protocols, procedures, etc.
Attack enemy	Demonstrate appropriate application of rules of engagement, tactics
Conversation/Dialog	Demonstrate appropriate communication protocols

Feedback Mechanics

Mechanic	Instructional Purpose
Cumulative performance bars	Immediate implicit feedback on performance. E.g., Merit bar increases as tasks are completed; Demerit bar increases as errors are made.
Persistent summary of state against ideal	Indicate potential limitations on current or future choices. E.g., heads-up-display elements showing current health
On screen time	Ensure students perform in a timely manner
Natural consequences	Demonstrate the consequences of an error without ending gameplay and implicitly show why performing correctly was important.
Interrupting positive / negative feedback	Alert student to performance above expectations or critical errors and ensure that students receive specific information explaining the alert.
Catastrophic end of the level/game	Teach the student that the behavior that caused the catastrophic event is not acceptable in any way – used for critical errors.
Game Ranking	Reinforce the importance of performing to an acceptable standard
Performance summary at end	Explicitly summarize strengths and weakness of the student's performance and provide appropriate guidance.

Exercise #6:
Instructional Mechanics

- Pick 1 of the gaming or instructional elements we've designed and describe it in terms of an instructional mechanic and/or instructional situation.

- 5 Minutes

Wrap-up Exercise

- Top X things learned today
- Top X challenges - revisited

- 5 Minutes – Each group member says the main thing they have learned today – no repeats
- If you have changed your view on your top perceived challenge in game design/development, then update it.

Thanks!!

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- Slides available at:
  - www.talibhussain.com (See publications link)

- Design of Learning Games Community Group:
  - http://groups.google.com/group/designoflearninggames

<p align="center">Have a Great Week!</p>

Tutorial Blurb

- This tutorial will introduce the participant to key concepts, steps and processes involved in designing a serious game for learning. Through hands-on activities and working together in groups, we will collectively design a game. Central to our approach will be ensuring that all key stakeholders are involved during creative and knowledge acquisition activities, and ensuring that any key design decision takes into account both the gaming and instructional implications. We start with identifying the training requirements and determining the learning objectives as well as the potential narrative contexts and scenarios for the training. As we achieve our initial footing, we identify the core knowledge and actions that the students will experience in the game, and begin to build our vision of the gaming experience. Questions of the deployment environment and its constraints, as well as the target student population guide the style of game we develop. Next, we segue to the design of specific mechanics and instruction in the game. We emphasize the concept of an instructional mechanic – which is a game mechanic applied for a specific instructional purpose. We design our key instructional mechanics and close with a brief summary presentation of the serious game design we have produced. Do our students learn effectively? Do the students enjoy the game? Is our customer happy? Do we win the proposal or secure continued funding? Well, that's something we can only answer when we apply these design principles in practice for a real world problem. However, tutorial participants can walk away assured that they have attained new insights into how to achieve those goals.