Swift Development of Immersive Learning Scenarios

Rob Nadolski & Hub Kurvers, CELSTEC, Open University of the Netherlands

Sector5 March 23-2010
Swift development of Immersive Learning Scenarios (ILS)

Overview

• Immersive Learning: characteristics + motives
• Shortcomings of existing platforms for ILS
• Exploration for solutions (brief)
• State of the art at CELSTEC: EMERGO
• Experience CSI-Heerlen
• EMERGO-toolkit
Immersion

Confucius (500 bC)

“Tell me and I will forget,

Show me and I may remember,

Involve me and I will understand ...”

with Pulse!!!
Immersion Learning: characteristics & motives

Experiencing emotions and reasoning in Authentic Environments

Active and interactive participation

Develop conceptual understanding (practicing: models-simulations)

Ability to perform scientific inquiry

Develop understanding about inquiry (reflection + natural feedback)

Solving authentic problems working on authentic tasks

All about: Authenticity - suspension of disbelief - motivation
Authentic Environments

= realistic problem situations, where learners participate as actor and constantly are being confronted with the consequences of their actions when applying knowledge and skills in finding solutions
Authentic tasks

Characteristics (Herrington, Oliver, Reeves, 2002)

- real-world relevance
- ill-defined (learners define subtasks themselves)
- complex tasks (time consuming)
- different perspectives (variety of resources)
- opportunity to collaborate
- opportunity to reflect
- integrated & different subject areas, beyond domain-specific outcomes
- real-world assessment
- competing solutions, diversity of outcomes
- polished products
Swift development of ILS page 7

with ENM

with Flash

(the great flu)

with Pulse!!!

with EMERGO

with Second Life
Shortcomings of existing platforms for ILS

Inflexible (monolithic & hard to adapt)

Not developed for supporting ILS (no educational glue)

Difficult to use (steep learning curve for all stakeholders)

Lack of standardisation

Expensive (e.g., licences)

Incomplete

Summarized: too few functionality and too high costs
Exploration for solutions: method + findings

a – wait  

b – explore existing platforms/engines  

c – built own

Criteria (top 4) &  
Basic Architecture (BA)

First sifting:  
- Criteria (top 4) &  
- Mapping on BA

Search candidates  
(websites, reports)

Pilots ILS with learners &  
research

Second sifting: criteria (10)  
Deploy small example  
(each BA-part)
Basic Architecture - blueprint

**User Input** (learner, teacher)

**Admin input**

**Author input**

**Authorization & Matchmaking - Architecture**

- Authorization & Session
- Matchmaking
- Error-reporting

**Authoring architecture**

**Authoring environment(s)**

**ILS-engines**

- **Adaptive Engine (Computational Engine)**
  - Coding
    - AI
    - Fuzzy logic
    - Model Solvers
    - State machine

- **Storage**

**Saving, Loading and Logging**

**Communication and Collaboration services**

**Sensors**

**Hardware (2D/3D) [graphical card]**

**2D/3D GUI**

**Rendering Engine**

**World**

**Resource management**

**Pilots ILS with learners & research**

**Technical setup BA-part** (maximum: 4)

First sifting:
- Criteria (top 4) à choose & Mapping on BA

Second sifting: criteria (10)

Deploy small example (each BA-part)

Swift development of ILS page 11
Basic Architecture - blueprint

User input (learner, teacher)

2D/3D GUI

Hardware (2D/3D) [graphical card]

Rendering Engine

World

Resource management

Sensors

Communication

Adaptive Engine (Computational Engine)

Coding

Artificial logic

Model Solvers

State machine

......

2D/3D GUI

Storage

Error-reporting

Authorization & Matchmaking

Authorization & Session

Matchmaking

Error-reporting

Installer

World-editor

Error-reporting

Authoring environment(s)

Scenario-templates

Pilots ILS with learners & research

Technical setup BA-part

First sifting:
- Criteria (top 4)
- Mapping on BA

Search candidates (websites, reports)

Deploy small example (each BA-part)

Second sifting: criteria (10)

Swift development of ILS page 12
Basic Architecture - blueprint

User input (learner, teacher)

Author input

Admin input

Authorization & Matchmaking

Authoring

Communication

ILS-deployment

Criteria (top 4) & Basic Architecture (BA)

Technical setup BA-part

First sifting:
- Criteria (top 4) à choose &
- Mapping on BA

Search candidates (websites, reports)

Pilots ILS with learners & research

Second sifting: criteria (10)

Deploy small example (each BA-part)

Error-reporting

Rule/State-editor

Installer

World-editor

World

Model Solvers

Model-editor

AI-editor

AI/fuzzy logic

Coding

State machine

Sensors

Scenario-templates

ILS-Editor/Engine

ILS-engines

Storage

2D/3D GUI

Hardware (2D/3D) [graphical card]

Authoring-architecture

Authoring environment(s)

Resource management

Saving, Loading and Logging

Error-reporting

Authorization & Matchmaking-Architecture

Authorization & Session

…

…

…

…

Swift development of ILS  page 13
Search candidates – some options \(\rightarrow\) first sifting

Criteria (top 4) & Basic Architecture (BA)  
Technical setup BA-part (maximum: 4)  
First sifting:  
- Criteria (top 4) & choose  
- Mapping on BA  
Search candidates (websites, reports)  
Pilots ILS with learners & research

Second sifting: criteria (10)  
Deploy small example (each BA-part)
Mapping on BA

ILS-deployment Architecture

User input (learner, teacher)

Admin input

Author input

Authorization & Matchmaking Architecture

EMERGO

Authoring

Scenario-templates

World-editor

Error-reporting

Error-reporting

Rule/State-editor

Matchmaking

Error-reporting

Installer

Authoring environment(s)

Resource management

Rendering Engine

Sensors

Communication

ILS-engines

World

Hardware (2D/3D) (graphical card)

2D/3D GUI

Storage

Swift development of ILS page 15

Communication and Collaboration services

Technical setup BA-part (maximum: 4)

First sifting:
- Criteria (top 4) & choose & Mapping on BA
- Search candidates (websites, reports)

Second sifting: criteria (10)

Deploy small example (each BA-part)
Mapping on BA

First sifting:
- Criteria (top 4) à choose &
- Mapping on BA

Search candidates (websites, reports)

Pilots ILS with learners & research

Second sifting: criteria (10)
Deploy small example (each BA-part)

ILS-deployment-Architecture
Authoring-architecture
Authoring environment(s)
ILS-engines
Storage
2D/3D GUI
Hardware (2D/3D) [graphical card]

Author input
Resource management
Rendering Engine
Saving, Loading and Logging
Communication and Collaboration services
Authorization & Matchmaking-Architecture
Admin input
Author input

Adapter input
ILS-Editor/Engine
Scenario-templates
World
Story-editor
Level-editor
Coding
AI/fuzzy logic
Model Solvers
State machine
Model-editor
AI-editor
World-editor
………..
Authorization&Session
………..
Matchmaking
………..
Error-reporting
………..
Installer

ILS-deployment-Architecture
User input (learner, teacher)

Swift development of ILS page 16
Mapping on BA

First sifting:
- Criteria (top 4)
  - choose
- Mapping on BA
  - Search candidates (websites, reports)

Second sifting: criteria (10)

Deploy small example (each BA-part)

ILS-deployment-Architecture

Technical setup BA-part (maximum: 4)

User input (learner, teacher)

Admin input

Author input

Caspian Learning
Blender

SecondLife-OpenSim
Unity
3D Gamestudio
DX-studio

SecondLife-OpenSim
Unity
3D Gamestudio
DX-studio

Caspian Learning
Blender

SECOND LIFE
OPEN SIM
UNITY
3D GAMESTUDIO
DX-STUDIO

Authoring-architecture

Authoring environment(s)

ILS-engines

Storage

2D/3D GUI

Hardware (2D/3D) [graphical card]

Author input

Resource management

Rendering Engine

Saving, Loading and Logging

Communication and Collaboration services

Authorization & Matchmaking - Architecture

Admin input

Adaptive Engine (Computational Engine)

Sensors

ILS-Editor/Engine

Scenario-templates

World

Story-editor

Level-editor

Coding

AI/fuzzy logic

Model Solvers

State machine

Model-editor

AI-editor

World-editor

………..

………..

………..

World-editor

………..

………..

………..

Authorization & Session

Matchmaking

Error-reporting

Rule/State-editor

Error-reporting

Installer

ILS-deployment

User input (learner, teacher)

Admin input

Author input

Caspian Learning
Blender

SecondLife-OpenSim
Unity
3D Gamestudio
DX-studio

SECOND LIFE
OPEN SIM
UNITY
3D GAMESTUDIO
DX-STUDIO

Authoring

EMERGO

Scenario-templates

World editor

Error-reporting

Error-reporting

Error-reporting

Installer

ILS-deployment

User input (learner, teacher)

Admin input

Author input

Caspian Learning
Blender

SecondLife-OpenSim
Unity
3D Gamestudio
DX-studio

SECOND LIFE
OPEN SIM
UNITY
3D GAMESTUDIO
DX-STUDIO

Authoring

EMERGO

Scenario-templates

World editor

Error-reporting

Error-reporting

Error-reporting

Installer

ILS-deployment

User input (learner, teacher)

Admin input

Author input

Caspian Learning
Blender

SecondLife-OpenSim
Unity
3D Gamestudio
DX-studio

SECOND LIFE
OPEN SIM
UNITY
3D GAMESTUDIO
DX-STUDIO

Authoring

EMERGO

Scenario-templates

World editor

Error-reporting

Error-reporting

Error-reporting

Installer

ILS-deployment

User input (learner, teacher)

Admin input

Author input

Caspian Learning
Blender

SecondLife-OpenSim
Unity
3D Gamestudio
DX-studio

SECOND LIFE
OPEN SIM
UNITY
3D GAMESTUDIO
DX-STUDIO

Authoring

EMERGO

Scenario-templates

World editor
Swift development of ILS page 18

Mapping on BA

Technical setup BA-part

Criteria (top 4)

First sifting:
- Criteria (top 4)
- Mapping on BA

Search candidates (websites, reports)

Pilots ILS with learners & research

Second sifting: criteria (10)

Deploy small example (each BA-part)

ILS-deployment-Architecture

Authoring-architecture

Authoring environment(s)

ILS-engines

Storage

2D/3D GUI

Hardware (2D/3D) [graphical card]

Author input

Resource management

Rendering Engine

Saving, Loading and Logging

Communication and Collaboration services

Authorization & Matchmaking-Architecture

Admin input

Adaptive Engine (Computational Engine)

Sensors

ILS-Editor/Engine

Scenario-templates

World

Story-editor

Level-editor

Coding

AI/fuzzy logic

Model Solvers

State machine

Model-editor

AI-editor

World-editor

………..

………..

………..

………..

………..

………..

Authorization&Session

Matchmaking

Error-reporting

Rule/State-editor

Error-reporting

Installer

ILS-deployment

User input (learner, teacher)

Covered by other

Auther input

EMERGO

Caspian Learning

Blender

SecondLife-OpenSim

Unity

3D Gamestudio

DX-studio

SecondLife-OpenSim

Unity

3D Gamestudio

DX-studio

Caspian Learning

Blender

SecondLife-OpenSim

Unity

3D Gamestudio

DX-studio

Caspian Learning

Blender

Covered by other
Mapping on BA

First sifting:
- Criteria (top 4)
  \[ \Rightarrow \]
- Mapping on BA

Search candidates (websites, reports)

Second sifting: criteria (10)
Deploy small example (each BA-part)

ILS-deployment-Architecture
Authoring-architecture
Authoring environment(s)
ILS-engines
Storage
2D/3D GUI
Hardware (2D/3D) [graphical card]
Author input
Resource management
Rendering Engine
Saving, Loading and Logging
Communication and Collaboration services
Authorization & Matchmaking-Architecture
Admin input
Adaptive Engine (Computational Engine)
Sensors
ILS-Editor/Engine
Scenario-templates
World
Story-editor
Level-editor
Coding
AI/fuzzy logic
Model Solvers
State machine
Model-editor
AI-editor
World-editor
... ...
Authorization & Session
... ...
Matchmaking
Error-reporting
Installer
Covered by other

User input (learner, teacher)

Authoring
EMERGO
Caspian Learning
Blender
SecondLife-OpenSim
Unity
3D Gamestudio
DX-studio

Admin input
Author input

ILS-deployment
Swift development of ILS page 19
State of the art at CELSTEC - EMERGO

ILS-deployment - Architecture

User input (learner, teacher)

Admin input

Author input

Authoring

ILS-engines

Storage

Sensor

Communication

2D/3D GUI

Hardware (2D/3D) (graphical card)

Rendering Engine

World

ILS-engines

Adaptive Engine (Computational Engine)

Encoding

AI/fuzzy logic

Model Solvers

State machine

ILS-deployment - Architecture

ILS-deployment

Scenario-templates

EMERGO

EMERGO

MATCHMAKING

Authorization & Session

Authorization & Matchmaking

Authorization & Matchmaking Architecture

Admin input

Author input

Storage

Error-reporting

User input (learner, teacher)

Author input

Authoring - Architecture

Author input

Admin input

Authorization & Matchmaking

EMERGO

Error-reporting

User input (learner, teacher)

Authoring - Architecture

Author input

Admin input

Authorization & Matchmaking

EMERGO

Error-reporting

User input (learner, teacher)

Swift development of ILS  page 20
EMERGO methodology & toolkit

Case development

Data entry initialisation

Data entry development

Case delivery

Case idea

Case scenario

Case development

Case delivery

Case evaluation

Data entry 'the brain'

Design

Scripting

conditions, constraints & actions)

Data entry 'the bones'

Components initialization

Components

Components

Case management

make case

Design

Staff-Portal

Design

Object states

GoogleMap

Design

GoogleMap

Design

Test

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components

Components
EMERGO toolkit

Components for data entry detailed scenario (development)
Player for testing (development) and delivery
Components for case delivery (delivery)
flexibility – reusability - maintenance

Case library: separation tasks and resources
flexibility – reusability - maintenance

Case library: separation tasks and sources
[exploitation partner 1 : structure, subset tasks-sources]
flexibility – reusability - maintenance

Case library: separation tasks and sources

[exploitation partner 2: other structure and subset]
EMERGO demonstrators/templates (examples)

CSI Heerlen (template logic reasoning and truth detection)  
[http://emergo.ou.nl/emergo/community/demonstrators.htm]
- single-user
- unexpected events
- time constraints
- score (compared to other players)

Limburg canon (template negotiation)
- multi-user
- prosuming
- score (competition)
Your experiences with CSI Heerlen

CSI Heerlen (template logic reasoning and truth detection)

• single-user
• unexpected events
• time constraints
• score (compared to other players)
EMERGO methodology & toolkit

Case development

Data entry initialisation
- Case management main cases
- Components initialisation

Data entry development
- Data entry 'the brain'
  - Design characters/roles
  - Design locations
  - Design EmPack
  - Design Tasks
  - Design Object states
- Data entry 'the bones'
  - Design Sources
  - Design e-messages
  - Design Announcements
  - Design Conversations
  - Itembank
- Data entry 'the flesh'
  - Design GoogleMap
  - Design StaffPortal
  - Design StudentPortal

Case delivery

Case idea

Case scenario

Case development

Case delivery

Case evaluation

Design
- Staff-Portal
- Student-Portal

Case runmanagement
- Case management main cases
- Run

Swift development of ILS page 28
EMERGO: data entry (Toolkit)  
EMERGO: player
Case development

Data entry initialisation

1. START
2. Case management
   - make case
3. Components
   - initialisation

Data entry development

- Data entry 'the brain'
  - Scripting (conditions, constraints & actions)
- Data entry 'the bones'
  - Design
    - characters/roles
    - locations
  - Design Empack
- Data entry 'the flesh'
  - Design Sources
  - Design e-messages
  - Design Announcements
  - Design Conversations
  - Itembank
  - Design Selections
  - Design Tests
  - Design GoogleMap
  - Design
    - Empack
    - Locations
    - Tasks
    - Object states

Case delivery

Data entry development

- Design
  - Student-Portal
  - Staff-Portal
- Case management
  - check case
- Case runmanagement
  - RUN

Swift development of
Data entry initialisation

START

Case management
make case

Components
initialisation

Data entry development

Data entry ‘the brain’

Scripting
(conditions, constraints & actions)

Data entry ‘the bones’

Design
characters/roles

Design
locations

Design
Empack

Design
Tasks

Design
Object states

Data entry ‘the flesh’

Design
Sources

Design
e-messages

Design
Announcements

Design
Conversations

Design
Selections

Design
Tests

Design
GoogleMap

Itembank

GoogleMap
Case delivery

Data entry development

Design
Student-Portal

Design
Staff-Portal

Case management
check case

Case runmanagement

RUN
Data-entry for CSI Heerlen

CSI Heerlen (template logic reasoning and truth detection)

- single-user
- unexpected events
- time constraints
- score (compared to other players)

Conversations component

Scripting component

- Predicate: condition + action(s)
- Condition types
- ........
Discussion & Questions
Thank you for your attention ... 

rob.nadolski@ou.nl
hub.kurvers@ou.nl
emergo.cc