Pedagogical Reasoning in Mobile Technologies

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Research interests on m-learning

- mutual encouragement
- affective domain
  - enjoyment
  - student engagement
  - teachers’ abilities
- infrastructure
- students’ perceptions
- distraction
- learning outcomes
  - attitudes
  - motivation
  - science experiments
- designing systems
- m-health
- engagement
- educational context
“The incorporation of mobile technology and pervasive learning can enhance the effectiveness and accessibility of learning activities in the future”.

“… it is timely to explore the future of science learning in light of the distinctive features of mobile-intensive pedagogies. ... There is a need for science educators to understand the nature of learning in mobile contexts”.

“… further research regarding the use of mobile technologies in all areas and levels of science learning will help science educators to expand their ability to embrace these technologies”.
“Future studies need to make use of newer, available technologies; ... Researchers need to make more explicit connections between the instructional principles and the design features of their mobile learning environment ... stronger alignment is needed between the underlying theories and measured outcomes”.


“... more elaborate instructional design developments are needed to more thoroughly exploit the educational benefits possible by utilizing mobile devices”.


“Informal learning is the most preferred approach carried out along with M-Learning”.

Search for m-learning 2007-2017

- ACM Digital Library 13,325
- ERIC 198
- IEEE Xplore 510
- JSTOR 295
- ScienceDirect 112
- SpringerLink 166
- Taylor & Francis Online 108
- Wiley Interscience 106
THE EXPERIMENT

experimental group

control group
Instructional design
Learning affordances
Semi-experiment
Zone of proximal development

Technological features
4G
System design
mLMS

You cannot understand.
you will never understand, you do not even try.

“All these technologies seemed to hold the potential of changing the way teachers teach and students learn. And yet they never seemed to live up to their potential. Why?

Part of the reason lies with the conservative nature of education”.

“Mobile Pedagogy if you will, will become an integral part of this new ecosystem”.


“... ‘seamless learning’, ... may be the most significant factor in encouraging educators to rethink their existing pedagogical patterns”.

We are one, inextricably linked, now and forever. Your movements guide my movements, my life guides your life.

Pedagogical reasoning

Comprehension

Reflection

Transformation

Evaluation

Instruction

Pedagogical reasoning, PACK and TPACK

[Toehler & Mishra, 2008; Shulman, 1987]
Instructional design

Mobile technologies

Instructional model
- Inquiry
- Collaboration

Instructional techniques
- Digital technologies
- Experiment

Learning theory
- Cognitive approaches
- [Social] constructivism

Learning objectives [e.g., Revised Bloom taxonomy]
- Remember
- Understand
- Apply
- Analyze
- Evaluate
- Create
Pedagogical use of digital technologies

Unique technological features / attributes / characteristics

- They record and store data and information
- They process data and information fast

Unique characteristics for learning

Representations
- Multimodal
- Dynamic
- Interactive

Communication
- Synchronous
- Asynchronous
Characteristics and affordances

1. Technological characteristics have certain potentials, they afford certain actions.

2. Technologies, such as mobile technologies, involve certain affordances.

3. The unique [technological] affordances lead to unique learning affordances.

4. [Unique] learning affordances lead to certain learning activities.
“An affordance signifies the perception of the environment of an agent in terms of the actions that can be afforded by it”.


“Affordances are “the actions permitted an animal by environmental objects, events, places, surfaces, people, and so forth”.


“Affordance is the property of objects to convey “important information about how people could interact with them””.

“Affordances “exist independent of being perceived” and “are specified by information and may be perceived”.

Affordances “are not defined with respect to particular animal effectivities”, “the properties of the animal that allow that action to take place in the environment”.

Why affordances are important?

“The success with which technology is utilised for learning and teaching depends on the educator's ability to appreciate the requirements within the learning context and subsequently select and utilise technologies in a way that meets those needs”.


“Many of the technologies available for educative purposes have not been designed specifically for learning and teaching, and thus the educator needs to analyse the affordances and constraints of such technologies to creatively repurpose them for the educational context”.

Affordances of mobile technologies

**Geotagging**, media recording capabilities, communications tools.


**Portability, social interactivity, context, and individuality.**


**Portability, Availability, Locatability, Multimediality.**


Flexible use, continuity of use, timely feedback, personalisation, socialisation, self evaluation, active participation, peer coaching, sources of inspiration outdoors, cultural authenticity.

Affordances of mobile technologies

Pedagogical uses
In situ contextual information
Recording
Simulation
Communication
First-person view
In situ guidance
Feedback
Distribution
Gamification

Educational quality
Engagement
Efficiency
Presence

Logistical and other implications
Hands-free access
Free up spaces

“Affordances are latent in the environment, objectively measurable and independent of the individual’s ability to recognize them, but are always in relation to the actor” (see individuality, engagement, etc.).


“Affordance is the property of objects to convey “important information about how people could interact with them”” (see socialization, educational quality, etc.).

In order to get the optimum effect of a technology, in our case mobile technology, we have to distinguish its unique affordances.

The design of applications in every domain has primarily to be based on the unique affordances of the particular technology, in our case mobile technology.

Of course, other affordances, common with other relevant technologies, may follow and be used.
Affordances of mobile technologies

The example of VR and MUVEs

1. Multisensory intuitive and real time interaction
2. Immersion
3. Presence
4. Autonomy
5. Natural semantics for the representation of objects and facts
6. Users’ representation through avatars
7. First-person user point of view
8. First-order experiences
9. Size in space and time
10. Transduction and reification.

(Mantziou, O., Papachristos, N.M., Mikropoulos, T.A. Learning activities as enactments of learning affordances in MUVEs: A review-based classification, to be published).
The unique affordances of mobile technologies

1. Ubiquity and pervasiveness
2. Geolocation
3. Sense
4. Finger control.
Mobile technologies incorporate these unique affordances of ubiquity and pervasiveness, geolocation, sense, and finger control, thus, they afford certain actions that lead to corresponding learning activities.

Therefore, there is a need to classify affordances that contribute to learning, namely learning affordances, as well as their association with learning activities.

Often used terms are “educational” and “pedagogical” affordances.

The term “educational affordances” involves not only the cognitive domain (learning), but also affective and psychomotor domains, as well as social and other issues.

For mobile technologies that involve the above domains, we prefer the more general term “educational” rather than “learning” affordances.
Educational affordances lead to learning benefits when they are supported by a solid theoretical framework.

Following the TPACK model, the educational affordances have to come from the merging of its three components that is technological, pedagogical, and content knowledge.

The [technological] affordances are incorporated into the technological knowledge circle of the TPACK model.
Educational affordances and activities

“Educational affordances are those characteristics of an artifact that determine if and how a particular learning behaviour could possibly be enacted within a given context”.


Pedagogical affordances provide “opportunities for exploration and manipulation to foster the construction of new knowledge”.

Educational affordances of mobile technologies

Thus, we classify the following educational affordances that result from the [technological] affordances of mobile technologies:

1. Creation (geolocation, sense, finger control)
2. Experimentation (geolocation, sense, finger control)
3. Real-time/anytime/anywhere information and content presentation and delivery (ubiquity and pervasiveness, sense, finger control)
4. Collaboration and cooperation (ubiquity and pervasiveness, geolocation)
5. Multichannel communication (ubiquity and pervasiveness, geolocation)
To validate the five unique educational affordances of mobile technologies, we have to associate them with learning / educational activities as appear in empirical studies.

An exhaustive review on empirical studies since 2000 in the fields of:

Physics
Chemistry
Biology
Geography
Environment
Learning activities in Science Education

**Games**
- Access to information through www
- Podcasting
- Gamification
- Tutorials and quizzes
- Field trips
- Multiple representations
- Geolocation-based design
- 3D molecular representations
- Virtual Labs
- Chemistry calculations
- Note taking
- Experiments with sensors
- Argumentation through SMSs
- Video recording
- Content delivery
- Experiments from distance
- Picture taking
- Note taking
- Video recording
- Content delivery
Learning activities in Science Education

Ubiquity and pervasiveness
Finger control

Learning activities

Commenting on spatial data
Geolocation
Sound-based mapping
Field work
Sensing
Experiments

Learning activities
Classification of the educational activities

Open coding

Axial coding

Selective coding

Classification of the educational activities

Selective coding

1. Content creation
2. Content exploration and interaction with content
3. Social interaction
4. Experimentation
5. Gaming

The selective coding learning activities give a more general level of abstraction that wouldn’t enable any changes.

This helps to associate learning activities to learning affordances.
# Activities and associated learning affordances

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<th>Learning activities</th>
<th>Learning affordances</th>
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<td>Content creation</td>
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Learning theories and strategies followed

- Contextualized learning
- Problem based approach
- Zone of proximal development
- Authentic learning
- Inquiry based learning
- Collaborative learning
- Constructionism
Why do we need affordances and educational affordances?

Figure 1. The affordance analysis e-learning design methodology: matching tasks with technologies to construct e-learning designs.

<table>
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