Transformative Learning in the Era of AI – How can Machine Learning Propel Deep Learning at NUST

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The grand aim of science is to cover the greatest number of experimental facts by logical deduction from the smallest number of hypotheses or axioms.

—Albert Einstein

Civilization advances by extending the number of important operations we can perform without thinking about them.

—Alfred North Whitehead
Transformative Learning – Why it is so Important

Deep Learning – What is it?

AI & ML – Why now

ML & Multi-Disciplinary
Transformative Learning Concept

Operant conditioning (also called instrumental conditioning) is a learning process through which the strength of a behavior is modified by reinforcement or punishment.

**Instrumental Learning**

- Thorndike’s Law of effect
  - “In a given situation, a response followed by a satisfying consequence will become more likely to occur and a response followed by an annoying consequence will become less likely to occur.”

**BOPPPS** approach in teaching methodology focuses on reinforcement

**Focusing more on the “What” and the “How”**
Transformative learning theory says that the process of "perspective transformation" has three dimensions: psychological (changes in understanding of the self), convictional (revision of belief systems), and behavioral (changes in lifestyle).
A disorienting dilemma

A self-examination with feelings of guilt or shame

A critical assessment of epistemic, sociocultural, or psychic assumptions

Recognition that one’s discontent and the process of transformation are shared and that others have negotiated a similar change

Exploration of options for new roles, relationships, and actions

Planning a course of action

Acquisition of knowledge and skills for implementing one’s plan

Provision trying of new roles

Building of competence and self-confidence in new roles and relationships

Transformations often follow some variation of the following phases of meaning:
The Transformative Learning Process

- Generalisation of past experiences
- Acknowledge automatic thoughts
- Life events, work, training and new learning provide the opportunity to critically reflect on past experience.
- Facing fears, challenging prior beliefs
- Development of new ideas, possible beliefs, attitude, and actions
- Reintegrate past experience and emotions
- Adding new information
- Try out, testing of new beliefs, attitudes and actions
- Experience evaluated via a process of reflection.
- New thoughts, feelings and beliefs
- Options:
  - Retain original assumptions
  - Revise original assumption(s)
  - Develop new understanding

The interpretation of the Transformative Learning process to show how the unconscious become conscious. The though bubbles show how this may be accommodated in the mind as the process occurs.
Through the process of deep learning, students learn to self-direct their own education and to adopt what is known as 'academic mindsets'; and they learn to be lifelong learners. “Deeper learning is the process of learning to transfer and create meaning of new information with the aim to take what’s was learned in one situation can be applied in another.” In this situation, learning becomes even more appealing if students receive constructive feedback helping them to trace the learning journey and highlight their behavior change in the process.

Deep learning instruction provides students with the advanced skills necessary to deal with a world in which good jobs are becoming more cognitively demanding. It prepares them to be curious, persistent, and independent learners as well as thoughtful, productive, active citizens in a democratic society.
Once the curriculum is finally developed, circulated for consultation, improved and approved by authorized bodies, we have what we call the **first dimension** of the curriculum development and implementation.

The three dimensions of curriculum development and implementation:

- **Dimension 1:** Intended curriculum
- **Dimension 2:** Implementation plan
- **Dimension 3:** Attained curriculum by the students

*The challenge is to ensure coherence among curriculum policy documents, the actual pedagogical process and learning outcomes.*
Various Technologies and Innovative Pedagogies

- TLU Portal
- MyNUST LMS
- ePortfolio
- Webex
- Turnitin
- MOOC
- Online Survey

Personal learning Environment
Innovative Pedagogies

- Blended Learning
- MOOC and OER
- Innovative Pedagogies
- Various Learning methods
- Mastery Learning
- Flipped Classroom
Learning Methods to Support Deep Learning

- Inquiry-based
- Problem-based
- Project-based
- Case Study-based
- Interdisciplinary-based
- System Thinking-based
- Acting on Learning-based

Professional Learning
Machine with the ability to:

- Construct knowledge
- Reason
- Develop problem solving skills
- Perceive and sense the environment
- Learn
- Plan
- Manipulate and move objects
- Etc.

Extracted from:
https://cdn-images-1.medium.com/max/1200/1*92h6Lq1Bu1F9QgoVNrkLdQ.jpeg
Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead.

The end results is that the machine teaches itself.
Machine learning Algorithms and where they are used?

Unsupervised Learning:
- Dimensionality Reduction
- Big Data Visualization
- Clustering
- Recommender Systems
- Targeted Marketing
- Customer Segmentation

Supervised Learning:
- Classification
- Regression
- Diagnostics

Reinforcement Learning:
- Game AI
- Skill Acquisition
- Learning Tasks
- Robot Navigation
- Real-Time Decisions

Supervision:
- Image Classification
- Identity Fraud Detection
- Customer Retention

Applications:
- Advertising Popularity Prediction
- Weather Forecasting
- Market Forecasting
- Estimating Life Expectancy
- Population Growth Prediction
- Diagnostics
Pick algorithms from existing libraries (Python)

Training of the algorithm following the standard steps ➔

• Collect the data
• Train the classifier
• Make predictions
Traditional Programming vs Machine Learning

Traditional Programming:

Data → Rules → Computer → Output

Machine Learning:

Data → Computer → Rules → Learn from experience
Monetising Machine Learning

In business
Machine Learning Reinforcing Multi-Disciplinary

Various application:
- Augmentation
- Automation
- Finance Industry
- Government Organisation
- Healthcare Industry
- Marketing
- Supply Chain
- Education, etc.

Projects Across Faculties or Across Department within a Faculty

- Computer Science and Informatics
- Health & Applied Sciences
- Nat. Resources and Spatial Science
- Human Sciences

Extracted from:
https://www.researchgate.net/profile/Nerida_Wilson/publication/320127813/figure/fig1/AS:546055521148929@1507201189112/Schematic-overview-of-how-to-achieve-advanced-cross-disciplinary-research-Different_Q320.jpg
# Moodle Tool Guide for Teachers

## What you want to achieve (pedagogy)

<table>
<thead>
<tr>
<th>Tool</th>
<th>What you want to achieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Transfer</td>
<td>Is it a tool for disseminating information from you to your students?</td>
</tr>
<tr>
<td>Assess learning</td>
<td>Will this tool allow you to assess your students' learning?</td>
</tr>
<tr>
<td>Communication &amp; interaction</td>
<td>Can it be used for communication &amp; interaction among participants (you &amp; your students)?</td>
</tr>
<tr>
<td>Co-create content</td>
<td>Can you &amp; your students collaborate &amp; create content together?</td>
</tr>
</tbody>
</table>

## Ease of use

How easy can this be set up by you?

- **Add Resource**
  - Upload a file (Word Document/PowerPoint)
  - Link to a web page
  - Use to send out course announcements
  - Use for many types of learning activities

- **News Forum**
  - Use to send out course announcements

- **Discussion Forum**
  - Use for many types of learning activities

## Add Resource

Upload a file (Word Document/PowerPoint)

- Easy, like an email attachment. But can your document stand on its own?
- Yes. Only teachers can upload files to course site. So definitely a push-tool.
- Maybe. Use to give task. Collect student files through Forum or Assignment.
- Maybe. Use to give task. Collect student files through Forum or Assignment.
- None. This is not a learning activity, but information transfer.

## Add Resource

Link to a web page

- Easy, find the web address (aka url – the bit that starts with http://), copy it, paste it.
- Very easy way of leading students to information. Can link directly to database articles.
- Not directly. Option is to link to external student e-portfolios or blogs.
- Maybe. Link to external tools e.g. Google Calendar, groups, blogs or wikis.
- Can do all of the above, depending on where you link to.

## News Forum

Use to send out course announcements

- Easy. It’s a standard forum, already set up in your course.
- Yes. Include course updates, encouragement, timely links, etc.
- No. The News Forum is limited. Students cannot post new topics.
- You can start new topics. Students respond. Great for establishing course rhythm.
- Limited because students cannot start new topics. Tip: Set up another Forum.

## Discussion Forum

Use for many types of learning activities

- Easy. Forum has usable default settings. A name & description is enough.
- Share resources as links or files. High message volume? Risk of losing info.
- Forum is versatile & allows this, e.g. design a formative assessment activity.
- Yes. Students communicate with you & peers. Interact as a class or in groups.
- Yes. Students can collaborate & explore topics, discuss them & write together.

## Bloom's

- Allows what thinking order?
  - Remember
  - Understand
  - Apply
  - Analyse
  - Evaluate
  - Create

*Not strictly learning activity. Test readiness for next class? R & U
Moodle Analytics Enhanced by Machine Learning

- Small Data
- Passive Reporting
- Proactive Reporting
- Silo’d Analytics
- Integrated Analytics
- Predictive Analytics
- Machine Intelligence Automation

Maturity:
- Big Data
- Operational
- Strategic
- Transformational

Dynamic future scenario modeling
Dynamic automated data driven decision making & machine action
Predictions through specific models, such as:
• Students at risks through well defined indicators
• Competence framework aligned to learning outcomes and graduate attributes
• Status of courses:
  ✓ Dormant
  ✓ Students enrolled but no lecturer and vice-versa – these are courses at risk of not to start
• Students performance (tests, assignments, formative assessments, etc.)
• Student progress in the course, etc.
Virtual Assistant as Student Support Tool

Unit 1 - MIL: An Introduction

Communication has always been central to human existence. In prehistoric times, people spoke by imitating birdsong, scratched information on walls, horns, stones, and shells, and sent messages by beating on drums, bells and gongs. As time went by, humans developed sophisticated oral communication through speech, song, oratory, and verse. Writing implements and symbolic systems became more complex, resulting in manuscript and print cultures. Transmission technologies like the telegraph, telephone, underwater cable, radio, and satellite, and the internet whisked messages around the world in record time. The image technologies of the camera, film and television added a vibrant, visual component to human communication. Most recently digital and nanotechnologies have delivered previously unimaginable communication tools into the hands of everyone, even small children.

Most of these technological advances have occurred within the last century, indeed many within the last twenty years. The changes in information and communication technologies (ICT) have been so fast and unevenly distributed that some people are faced with more and more information every day, while others are still starved for information. Yet, the societies in which we live today are driven by information and knowledge.
The AI-enabled robots teach lessons in Biology, Chemistry, Geography, History and Physics to Classes 7-9. As per the Collaborative Learning Model (CLM), the man-machine team, comprising a teacher, students and the robot, collaborate in the classroom to deliver a lesson. The teacher collaborates with the robot and brings out the key concepts, relevance and application of the lesson being taught.”
"AI is changing the knowledge and skills students need for success in a global, knowledge-based, innovation centered civilization. To accomplish these ambitious educational outcomes, AI is also enabling novel, powerful methods of teaching and learning.

A novel teaching method composed of Self-study, Test, Question and Discussion (STQD) sessions uses self-, peer-, co-, active learning, inductive teaching, and formative assessment to promote student-centered teaching.
Sophia may be a teacher – isn’t it?

1) https://www.youtube.com/watch?v=S5t6K9iwcdw

2) https://www.youtube.com/watch?v=kWll4KjiP4M