



STL and Complex Problems

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Student Learning Time (SLT)

- Effective learning time or student effort in learning or the learning volume (a quantitative measurement of all learning activities) in order to achieve the specified learning outcomes
- Include all learning activities formal and non-formal
- Total time required by student to learn a particular component of curriculum: Official Contact Time + Guided Learning Time + Self Study Time (Independent learning) + Assessment Time
- Synonymous to student's academic load, e.g. credit hours





Student Learning Time (SLT)

Effective Learning Time or Student Academic Load (SAL) or Learning Volume can be in a variety of ways:

- About 8 hours/day
- 40-48 working hours/week
- 560-670 hours/14 week semester
- Normally 15 16 credits per semester
- 1 Credit Hour about 40 SLT (per semester)





Student Learning Time (SLT)

- Management instrument for both the directed, guided and independent learning,
- Component of time management SLT promotes ethics and discipline in student's effort towards learning
- Enhancing "life-long-learning" skills
- An indicator of effort in learning and study smart
- Educate on how the "learning by doing" in respect to effort in learning i.e. student-centred outcome-based approach
- Effective control of prescribed study duration





Guideline for Estimating SLT & CAL (Course Academic Load)

Teaching modality	Time (hr) per unit of	Additional time to be	Total time (hr) per unit
	teaching	added (hr)	of teaching
Lecture	1	1-2	2-3
Tutorial	1-2	1-2	2-4
Lab Practical	3	2-3	5-6
Small Group Discussion	1-2	1	2-3
Fixed Learning Module	3	0	3
Problem-based learning	2-3	2-3	4-6
Presentations	1	3-4	4-5
Each 2000 word written assignment	10-20	0	10-20
Case summary (per case)	3	0	0
Research Project (total)	240-400	0	240-400





Guideline for estimating SLT & CAL (Course Academic Load)

Teaching modality	Time (hr) per unit of teaching	Additional time to be added (hr)	Total time (hr) per unit of teaching
Industrial training (total)	320 (should be at least 2 months)	0	320
Demonstration per session	1-2	0	1-2
Electronic/Online learning per session	3-5	0	3-5
Clinical per session	Whatever time that has been allocated	0	Whatever time that has been allocated
Field work per session	Whatever time that has been allocated	0	Whatever time that has been allocated





Complex Problem

Need to think broadly and systematically and see the big picture **Complex Problem Difficult Decision Uncertain** Strategy **Confusing** Idea **Contentious Product** Intractable Change





Difficulty & Uncertainty

- Complexity the problem contains a large number of diverse, dynamic and interdependent elements
- Measurement it is difficult or practically unfeasible to get good qualitative data
- Novelty there is a new solution evolving or an innovative design is needed





Characteristics of Problems

Technical Problems

- Isolatable boundable problem
- Universally similar type
- Stable and/or predictable problem parameters
- Multiple low-risk experiments are possible
- Limited set of alternative solutions
- Involve few or homogeneous stakeholders
- Single optimal and testable solutions
- Single optimal solution can be clearly recognised

Complex Problems

- No definitive problem boundary
- Relatively unique or unprecedented
- Unstable and/or unpredictable problem parameters
- Multiple experiments are not possible
- No bounded set of alternative solutions
- Multiple stakeholders with different views or interest
- No single optimal and/or objectively testable solution
- No clear stopping point







Complex Problem

Scientific/Technical
Problems
can combine to
formImage: Complex problem
Complex problem





Complex Problems (Need High Taxonomy Level)

Complex Engineering Problems have characteristic WP1 and some or all of WP2 to WP7, EP1 and EP2, that can be resolved with in-depth forefront knowledge

WP1	Depth of Knowledge required	Resolved with forefront in-depth engineering knowledge (WK3, WK4, WK5, WK6 or WK8) which allows a fundamentals-based, first principles analytical approach
WP2	Range of conflicting requirements	Involve wide-ranging or conflicting technical, engineering and other issues.
WP3	Depth of analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.
WP4	Familiarity of issues	Involve infrequently encountered issues
WP5	Extent of applicable codes	Beyond codes of practice
WP6	Extent of stakeholder involvement and level of conflicting requirements	Involve diverse groups of stakeholders with widely varying needs .
WP7	Interdependence	Are high level problems including many component parts or sub-problems.
EP1	Consequences	Have significant consequences in a range of contexts.
EP2	Judgement	Require judgement in decision making





Problem Oriented, Team-Based Project Work as a Learning/Teaching Device

- 1. Problem-oriented project-organized education deals with the solution of theoretical problems through the use of any relevant knowledge, whatever discipline the knowledge derives from. We are dealing with KNOW WHY (Research Problems)
- 2. In design-oriented project work, the students deal with **KNOW HOW** problems that can be solved by theories and knowledge they have acquired in their previous lectures (Design Problems)







Problem Organised Project Work or POPBL (Project Oriented Problem Based Learning)







How is complexity integrated into the curriculum?

- Final Year Project Complex Problem Solving
- Industrial Placement
- Design Project *Complex Engineering Activities*
- General Courses
 - Core & Specialist (Engineering) Courses Complex Problem Solving
 - Elective Courses Complex Problem Solving





Lessons learnt from Accreditation Activities related to Assessment

- Does not know the Teaching Plan
- Done without Referring to the Plan
- Does not know How to Translate Plan into Assessment
- Assessing at Low-Medium level (not Challenging)
- No Feedback to Students except at the End of Semester
- Does not know How to Relate Assessment to Expected Outcomes
- Repetition
- Bulk Marking
- Traditional Assessment







THANK YOU

FOR LISTENING