The state of System Dynamics education: ***Accumulating better practitioners***

Panel Discussion

Inspired by the System Dynamics Competence Framework for Teaching SD by Martin Schaffernicht and Stefan Groesser (published in the SD Review)
(http://onlinelibrary.wiley.com/doi/10.1002/sdr.1550/full)

Overview

- Motivation
- Survey: https://cardiff.onlinesurveys.ac.uk/survey-of-sd-teaching-practices

  Preliminary survey results

- Panel-group discussion
  - Sally Brailsford
  - Siôn Cave
  - Jim Duggan
  - Hisham Tariq

Respondents

Trainer expertise vs. proportion of main job using SD	**0 to <25%**	**25 to <50%**	**50 to <75%**	**75 to 100%**
Competent (C)	5%	0%	0%	0%
Proficient (P)	5%	5%	0%	0%
Expert (E)	37%	21%	16%	5%
Master (M)	0%	0%	0%	5%

- Most have >10 years experience of using *and* teaching SD

Preliminary survey results

Top Tips

- ✓ *Always* have a working model
- ✓ Use stocks and flows with data and time-charts – don't focus only on the qualitative structure
- ✓ Hands-on examples
- ✓ Use your *own* case studies and examples vs. Use *simple* examples not from specialist field of the learners

- ✓ Start with simple models
- ✓ Explanation is key – ensure the basic principals are fully understood
- ✓ Take it slowly and be prepared for students to find it difficult - *reassurance*
- ✓ Get students to identify the key structure from a stock and flow format

- ✓ Model the issue not the data!
- ✓ Include teaching on data – how to populate the model (sources, quality, quant & qual)

- ✓ Audience background essential for orienting training
- ✓ Assess current ability and start there; "*when in doubt, bias towards the basics*"

Skills develop in stages

Skills		Complexity Level (cl)	Competence Development Stages				# of Learning Outcomes
			Beginner	Advanced Beginner	Competent	Proficient	
7	Policy evaluation and design	cl3			2	4	6
		cl2		2	4		6
		cl1		3	3		6
6	Model validation	cl3			7	2	9
		cl2		7	2		9
		cl1	1	7	1		9
5	Model creation	cl3		1	14	10	25
		cl2		15	10		25
		cl1	1	22	2		25
		n. a.		11	6		17
4	System dynamics project initialization	cl3			3	6	9
		cl2		4	5		9
		cl1		9			9
3	Model analysis	cl3			9	4	13
		cl2		10	3		13
		cl1		13			13
		n. a.		1			1
2	Dynamic reasoning	n. a.	3	9	3		15
1	System dynamics language	n. a.	10	26	10		46
Total numbers of outcomes			15	140	84	26	265

Skills

- Language
  - Bookwork and formal definitions
  - Vs. analogies, real world examples, stating with simulation
  - Vs. not covered specifically just trainer consistently using terms

- Dynamic reasoning
  - "Follow the causal logic"
  - Emphasis of *over time*
  - Case studies / examples *then* formal definitions
  - Simple, small models for experimentation

- Model analysis
  - Divide and conquer
  - Use differences as the learning route (differences between real world and model)
  - Case studies / examples
  - *NOT* using causal loop diagrams
  - Coursework *adapting* an existing model

Skills

- Project initialisation
  - Is SD the right tool?
  - Careful requirements defintion
  - Focus on structure in case studies – not building from scratch
  - Beyond the scope of Beginner/Adv. Beginner?

    Or covered elsewhere (general OR modelling approach)

  {Flagged as needing room for improvement}

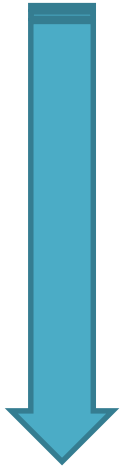
- Model creation
  - Focus on 'observable' variables
  - *Live* model building → never be further than 30mins away from a working model
  - *Extend* rather than create from scratch

    Or create a model together for students to develop themselves
  - Low focus on equations → structure focus (and tools to view it *nicely*)

Skills

- Model validation
  - Devise steady state and then add
  - *Inseparable* from creation teaching
  - Case studies and encouraging use of *reference models* when building
  - Coverage can be limited by teaching method and limits of licensed software (free versions)
  - Bookwork → Sterman
- Policy evaluation and design
  - Not covered by several respondents
  - Demonstrate good *and* bad outcomes
  - Model *without* policy implications first… then introduce these decisions
  - Group work → trial solutions on a *running* model
- Long thin teaching

Competency Weightings



(D) Project initialisation

(E) Model creation | (F) Model validation

(C) Model analysis

(B) Dynamic reasoning

(G) Policy evaluation and design

(A) Language