ADAPTIVE LEARNING ENVIRONMENTS: Motivation, Affect, etc

Motivation: Looking for definitions

Like "intelligence", a word that gets bandied about in the literature without an agreed definition of what it means!

Mini-activity: Take a few minutes and write a definition of what you think "motivation" means in an educational context (in pairs)
+ 2 examples of a student being motivated
+ 2 examples of a student NOT being motivated

Definitions (from class discussion):
1. Inspiration or desire to continue learning
2. Desire to learn in order to achieve a goal
3. Willingness and interest to learn
4. The desire to learn about something
5. Willingness to fullfil a task
6. How much the student is invested in learning and distinguish intrinsic and extrinsic motivation
7. Short and long term motivation
8. Long and short term goals

Examples of a student being motivated:

1. If give option to stop and they choose not to
2. Try and do the work themselves rather than get hints
3. When the student asks questions
4. They try to do extra work or extra analysis
5. When efficiently working
6. Tries do do things independently, asks questions of teacher

With help:

1. When there is competition, when you want win, or do better than others
2. When they are focused and engaged
3. Feeling positive feelings like interest and involvement
4. Negative motivation – fear of failure

Examples of a student NOT being motivated:
1. Distracted from task
2. Working slowly, large pauses (not on task, not goal oriented, or showing anxiety)
3. Using help to get hints – gaming the system
4. Answering "I don't know" a lot!
5. Unrelated activity
6. Not performing to usual expectations
7. Not engaged
8. Not actually learning
9. Not paying attention when answer available

Mini-activity: related questions....

Is motivation monolithic?

Is it something you have or you don't?

What's the relationship between motivation and learning gains?

....Between motivation and affect?

How do we tell if someone is motivated or not?

How do we try to motivate them, if they aren't?

Should we even do that?

Looking for definitions

From the OED, "Motivation" definition 1b.

"The (conscious or unconscious) stimulus for action towards a desired goal, esp. as resulting from psychological or social factors; the factors giving purpose or direction to human or animal behaviour. Now also more generally (as a count noun): the reason a person has for acting in a particular way, a motive."

Bad researchers!

Many papers may not explicitly operationalize motivation, or relevant sub-concept thereof.

In a large review from 2000 (when there was much less literature), Murphy & Alexander say that out of 120 items in review:

> "51...used the word motivation. Yet, only in 4 (8%) of those occasions was this term explicitly defined.... An implicit definition was provided in 17 (33%) of the studies, whereas *no definition was evident in 30 (59%) of the documented cases.*" (p. 33, emphasis added).

Keep in mind...

A disputed area with many competing terms, theoretical orientations

Surprisingly little agreement on issues of...
- How, when, why motivation may impact learning
- How, when, why it may impact/ be impacted by affect
- Whether learners have any reliable access to their own motivational states

Looking for definitions

A comprehensible research definition (re: education)

"Motivation can be broadly defined as the force behind action that explains why a person acts in a particular way." (du Boulay et al, 2010, p. 200)

"What drives the learner to learn or not to learn, what they think they are going to achieve, why they are learning at all and the social and temporal milieu within which the learner is learning." (same paper, Table II, page 214).
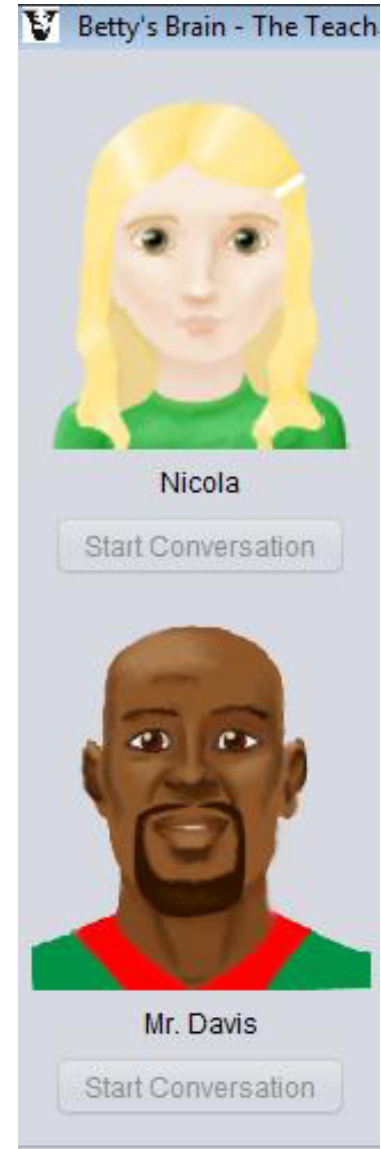
We've heard this before

Betty's Brain: Big on motivational aspects

Taking on teaching role that may drive student to expend additional care and effort

"There is a strong motivation component of teaching where the teacher needs to take responsibility (and joy) for the learning of their pupils." (Biswas et al, 2005, p 366)

Also, (simulated) social interaction with Betty as designed to increase the engagement, level of investment in the learning

We've heard this before

Crystal Island frequently discusses motivation as a facet of learner *engagement with system*

Team points at presence of an interesting (but not overly complex) narrative as a factor in **students being driven to actually finish the game** and its embedded content/tasks (see Rowe et al, 2011)

Game elements such as **immersive graphics** as positively contributing to motivation, at least for some students

Next slide: Screenshot of interaction with character in Crystal Island camp kitchen

Score: 12

Quentin:

Food supplies are running a bit

Time Remaining: 41:17

Defining Affect

This is a little simpler than defining motivation
- Better agreement on WHAT it is
- Less agreement on which aspects are
        relevant, and when, and to whom

For educational context, in plainest English:

AFFECT = emotions related to learning; how learner feels about learning task or context

Mini activity:
Which emotions do you think might be most relevant to learning?

Emotions for learning?

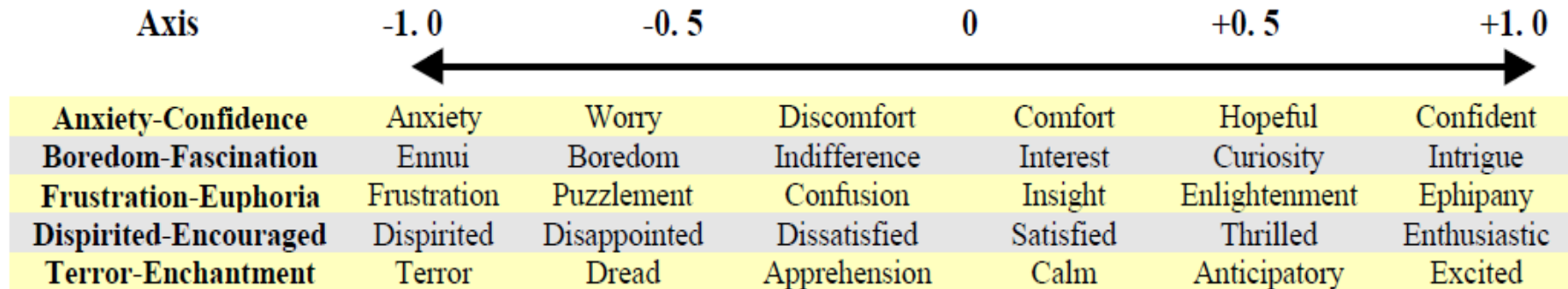| Axis	-1.0	-0.5	0	+0.5	+1.0
Anxiety-Confidence	Anxiety	Worry	Discomfort	Comfort	Hopeful	Confident
Boredom-Fascination	Ennui	Boredom	Indifference	Interest	Curiosity	Intrigue
Frustration-Euphoria	Frustration	Puzzlement	Confusion	Insight	Enlightenment	Ephipany
Dispirited-Encouraged	Dispirited	Disappointed	Dissatisfied	Satisfied	Thrilled	Enthusiastic
Terror-Enchantment	Terror	Dread	Apprehension	Calm	Anticipatory	Excited

Figure 1 – Emotion sets possibly relevant to learning

A proposal from Kort et al. (2001). *Short (4 page) and highly recommended paper.*

To paraphrase them, this diagram is theoretical only and needs evaluation to see if these emotions and their organisation are the "right" ones

Autotutor to the rescue

Autotutor has extensively studied which emotions present when learning with an ITS. *See D'Mello & Graesser (2012) required reading for summary of this research, its methods*

They propose set of relevant, frequently present *learning-centred emotions:*

boredom

flow/engagement

confusion

frustration

delight

surprise

Any surprises about this list?
Note the differences from Ekman's "basic emotions" heavily used in psych.

-> **They do NOT claim list is universal for all learners, contexts!**

Who cares about feelings?

Various research suggests we cannot separate
motivational, affective, cognitive aspects of learning
 - These matter both in classroom and in a computer-
   based learning context
 - Lots of papers– suggest start with Autotutor
 (Left to your independent reading as is a HUGE field)

Generally learning contexts (classroom, system, etc.)
more likely to address affect, motivation as a means to
some end that has to do with learning gains *(More on
this momentarily)*

"We should not lose sight of the fact that most **systems are designed...to improve the cognitive state of the student. They employ motivational, metacognitive and affective reasoning as a means to this end.** So their pedagogy focuses on diagnosing the student's state, and if that state is sub-optimal with respect to learning, helping the student move into a state more conducive to learning. Once the student is in a good state for learning the pedagogy aims to maintain that state."

(du Boulay et al., 2010, p 205, emphasis added)

Modelling-for-doing

Crucial underlying assumption within this picture from du Boulay et al (2010) and Autotutor studies is that **we can MODEL these various states (cognitive, motivational, metacognitive affective...)**

When we are modelling we are ***modelling for reasoning and for doing something.*** Per du Boulay et al, we might want to reason about:

Causes of these various states e.g situational factors
- different causes will almost certainly necessitate different actions
- e.g. bored because too easy, vs. way too hard

Modelling-for-doing, cont'd

Aside from causes, might reason about:

- **How various events may affect the states** (e.g. successfully solving a problem)
- How or whether **system actions that could change the student states** (generally from less-desired state to one "more conducive to learning"), and thus which action to do.

This should sound similar to the steps/ types of actions we discussed re expert human tutors: diagnosis, planning, action (and adaptivity in all these).

As though following du Boulay et al. like a script, here is some commentary from Autotutor on this very point:

"...affect-sensitive variants of AutoTutor detect and respond to boredom, confusion, and frustration. Appropriate responses to these states could potentially have a positive impact on engagement and learning outcomes.... AutoTutor [has] a set of production rules that were designed to map dynamic assessments of the student's cognitive and affective states with tutor actions to address the presence of the negative emotions... Hence, the learner and the tutor are embedded into an affective loop that involves *detecting* the learner's affective states, responding to the detected states, and *synthesizing* emotional expressions via animated pedagogical agents."
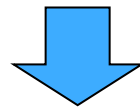
 (D'Mello & Graesser, 2012, p. 130) This was required reading

Tutor tasks are also ITS tasks **

Diagnosis: the ability to diagnose the student *in a specific context*
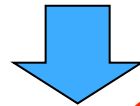
Planning: the ability to plan *appropriate* actions based on the diagnoses

But what are these?

Action: the ability to act upon their diagnosis and plans

PLUS **adaptivity** to unfolding interaction, **iteration** of diagnosis, planning, action.

Human tutors are indirect

Remember: Big benefit of using natural language is that we are already "expert users". Already understand many **strategies** for doing things with language.

ONE key strategy for effectiveness of human tutoring is the **indirectness of dialogue moves** (there are other strategies!)

As we considered earlier, consider the impact of the tutor saying:

"No, that's completely wrong!"

versus   "Hmm, why do you think the answer is 42?"

Why indirectness, again?

Facilitate **"balancing act"** between student doing the work, and just-enough, just-in-time guidance.

- Signal that there may be an error (but not what)
- Re-directing attention to relevant concept or problem, rather than giving answer

Indirectness (of tutor) has **important affective and motivational benefits** for learner

- Leaving "the work" to student (e.g. help them to identify and correct own error) leaves them the control
- In plain English: *we feel better about ourselves and our learning when we have that indirect guidance*

Remember: Dialogue for DOING

Different responses are different dialogue "tools"

They allow the tutor to achieve slightly different communicative and educational **goals** to various degrees:

- **Tell** the student his answer was problematic
- **Prompt/guide** the student to make further attempts at finding a solution.
- **Motivate** the student; **boost** the student's confidence and curiosity

Dialogue & teaching in core systems, again

1. **TEACHING:** identify the view of teaching (or balance of the views) that appears to be implicitly or explicitly present in that system.
2. **DIALOGUE:** What type(s) of dialogue-based interactions are present in the system?
3. **TEACHING VIA DIALOGUE:** How does the dialogue in the system embody that view of teaching, and work to achieve the system goals?

PLUS

4. AFFECTIVE AND MOTIVATIONAL GOALS: What are they, and how does dialogue work to achieve those goals?

Sharing your findings

1. Your group pairs up with another system group

2. Report your "key findings" from the exercise, and your key evidence

3. Groups discuss similarities, differences, and any unanswered questions