# A New Meta-Model of Student Engagement: The Roles of Student Motivation and Active Learning

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## Abstract

*This paper presents a new meta-model of student engagement incorporating the roles of student motivation and active learning. The student motivation model itself is based on the "expectancy × value" model thoroughly developed by Wigfield and Eccles. The active learning model is based on the popular "active learning continuum" of Bonwell and Eison. A primary advantage of this meta-model is presenting student engagement in terms of atomic components, combined in a clear, concise framework. The interaction of these components is clearly defined, and importantly, they are directly addressable by educators, providing "handles" on which to approach, foster and promote student engagement. The meta-model is sufficiently general to be truly interdisciplinary. Further, it allows for the quantification of student engagement. Initial results using survey data provide evidence that the given quantification method is representative and valid. The contribution is a simple, clear framework which educators can use to investigate, quantify and apply approaches to better engage students.*

## 1. Introduction

The topic of student engagement has been the focus of substantial research for the past few decades. Much of this has been inspired by the paradigm shift proposed by Barr and Tagg, from a system focused on merely providing instruction (the Instruction Paradigm) to a learner-centric system which maximizes student learning (The Learning Paradigm) [1]. Barkley [2] provided a popular definition for student engagement as the *product* of motivation and active learning. It is defined as a product (not a sum) of these components because engagement will not occur if either is not present in any quantity. Thus, engagement results from the intersection of these components (see Figure 1).

Barkley further states that "Student Engagement is complex, and the model of student engagement as the synergistic interaction between motivation and active learning is simply one contribution to on-going discussion on what student engagement means and how to promote it" [2]. This is a key concept in fostering student engagement, as the degrees of control that the teacher has over the factors of motivation and active learning differ quite dramatically. Motivation largely (or entirely) stems from the student alone. According to [3], student motivation "…explains the degree to which students invest attention and effort in various pursuits which may or may not be the ones desired by their teachers". Further, student motivation is rooted in subjective experiences, particularly those connected to their willingness to engage in learning activities and their reasons for doing so. Thus student motivation is one of these two factors over which the teacher has more limited control. Attempts may be made to foster, even channel and promote it, but it *cannot be created* by the teacher—this can only be done by students themselves. Biggs and Tang also argue that there *cannot* be a total lack of motivation:

> "There is no such thing as an unmotivated student: all students not in a coma want to do *something*. Our task is to maximize the chances that what they want to do is to achieve the intended learning outcomes. Unfortunately there are many aspects of teaching that actually discourage them from doing that: we need to identify and minimize these as far as we can" [4].

The case is quite different for active learning, as it *is possible* to create (at least theoretically) a teaching and learning environment *completely devoid* of active learning (and therefore possible to create one completely *full* of active learning). Thus, active learning is the component of student engagement over which the teacher has arguably total, (certainly more) control, when compared to motivation—over which the educator has little (or no) direct control.

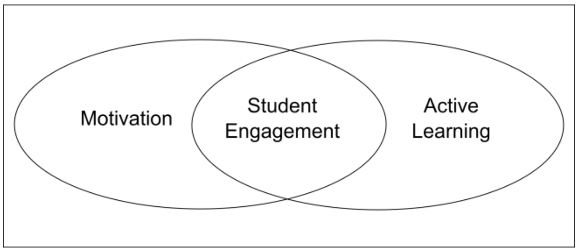


**Figure 1. Venn diagram of student engagement model, adapted from [2].**

## 2. Incorporating student motivation: expectancy and value

Light, Calkins and Cox state that traditionally student motivation has been viewed within two dimensions, intrinsic and extrinsic. Intrinsic motivation is when a student acts out of spontaneous interest or an inherent satisfaction in seeking out novelty or challenges [5]. This is opposed to extrinsic motivation where a student seeks to attain a separate outcome. However to some researchers, distinguishing between these two types of motivation is not enough to fully encapsulate what moves people to act (or not to act). A more useful model which has precipitated from what research has revealed about motivation can be organized within the *expectancy* × *value* model, thoroughly developed by Wigfield & Eccles [6], a paper that has over 1,300 citations [7]. In the *expectancy* × *value* model, motivation is seen to be the product of expectancy and value (see Figure 2), just as engagement is seen to be the product of motivation and active learning. More contemporarily, according to Brophy [3], the model holds that the effort students are willing to invest in an activity (learning) is the product of:

1. The degree to which students can *expect* to be able to perform the activity successfully if they apply themselves, thus *expecting* to get whatever rewards that successful performance will bring.
2. The degree to which students *value* those rewards as well as the opportunity to engage in the processes involved in carrying out the activity itself.

The reason that student motivation is seen as a product (and not a sum) is that because without any of either expectancy or value, no motivation will be generated. This is the same reason that student engagement is seen as the product of motivation and active learning—without any quantity of one or the other, no engagement will be generated.

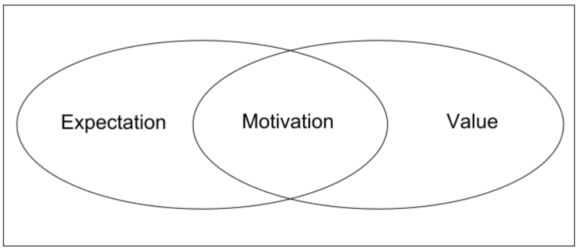


**Figure 2. Venn diagram model of student motivation**

As atomic (irreducible) components, expectancy and value have direct implications on student motivation and therefore engagement. This can be seen by combining the models presented here for student engagement (see Figure 1), and student motivation (see Figure 2). This combination results in a meta-model where student engagement is the intersection of expectancy, value and active learning (see Figure 3).

Therefore, educators can increase student motivation (and therefore engagement) by increasing the value of student learning, and helping students in having obtainable yet optimistic expectations on the outcomes of that learning. As a summary, Table 1 shows anticipated student responses to engaging in a learning task as the expectancy and value aspects are influenced positively or negatively. Identifying students' expectations and values can allow educators to tailor the delivery of learning to increase motivation and therefore engagement.

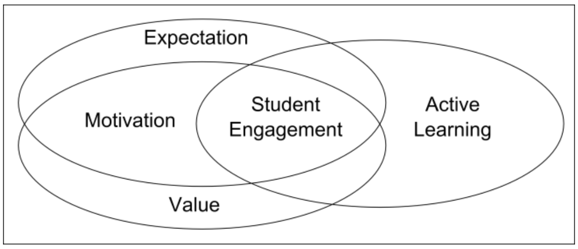


**Figure 3. Venn meta-model of student engagement including motivation components**

**Table 1. Student response to tasks related to expectancy and value perceptions, adapted from** [3]

| | **If a student *expects* to succeed…** | **If a student *does not expect* to succeed…** |
|---|---|---|
| **…and *values* the task** | The student will probably engage in the task, eager and happy to focus on developing knowledge and skills by seeking to discover meanings, grasping new insights, and generating integrative interpretations. | The student might dissemble and make excuses, pretend to understand, or deny having difficulties, focusing more on protecting the ego than on developing task-related knowledge and skill. |
| **…and *does not value* the task** | The student might evade the task by doing the minimum that is required to get the task done, but his or her heart and mind won't be engaged in it; attention will be scattered, drifting to competing interests. | The student will probably resist or reject the task. If the task is required, the student may do it resentfully, angry at being coerced into a perceived unpleasant, pointless activity that may also prove to be embarrassing and reinforce negative self-perceptions of low ability. |

## 3. Incorporating active learning: the learning continuum

In their seminal paper, *Active Learning: Creating Excitement in the Classroom*, Bonwell and Eison popularized the concept of active learning. In the paper, which has over 2,000 citations [8], it is stated that "In the context of the college classroom, active learning involves students in doing things and thinking about the things they are doing". Further,

> "They [students] must read, write, discuss, or be engaged in solving problems. Most important, to be actively involved, students must engage in such higher-order thinking tasks as analysis, synthesis, and evaluation. Within this context, it is proposed that strategies promoting active learning be defined as instructional activities involving students in doing things and thinking about what they are doing" [9].

Amongst the major characteristics of active learning described in [9] are increased student *motivation*, and students being *engaged* in activities. This further supports the relation of active learning with engagement and motivation.

Active learning has been the focus of intense interest and research recently, with a large part of this research being focused on techniques for applying active learning to specific disciplines. A discussion on active learning techniques is beyond the scope of this paper as it is only the relationship of the concept of active learning to student engagement being investigated. For a comprehensive bibliography on active learning (including many discipline-specific works) see [10].

To maintain a discipline-independent stance active learning may be considered to be any learning environment where the mind is actively engaged. Its defining characteristics are that students are dynamic participants in learning and that they are reflecting on and monitoring both the processes and results of their learning [2]. Bonwell and Eison took a simpler approach which they termed the *learning continuum* (see Figure 4). In [9], the learning continuum is described as (emphasis inserted by present author):

> "A conceptual framework encompassing active learning might be a continuum that moves from simple tasks on one end to complex tasks on the other. This is, of course, an artificial, oversimplified construct, but it does provide both a visual and conceptual model that is *useful for designing courses that maximize students' intellectual engagement*. Neither end of the continuum is considered to be "better" or more "desirable" than the other. Simple tasks are defined as short and relatively unstructured, while complex tasks are of longer duration—perhaps the whole class period or longer—and are carefully planned and structured".

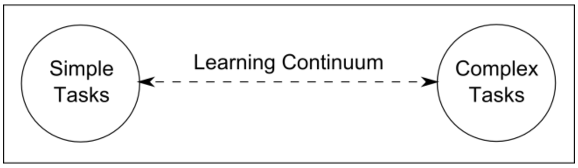


**Figure 4. Bonwell and Eison's active learning continuum**

The discipline independence and simple applicability of the active learning continuum allows the meta-model of student engagement to be completed by including this component of active learning (see Figure 5). Further, although described by its creators as "oversimplified", this construct will prove to be useful and sufficient when quantifying student engagement and its components.

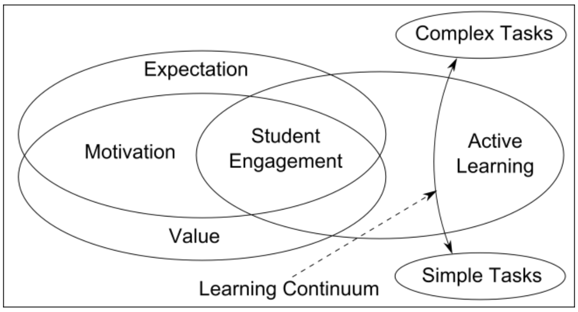


**Figure 5. Venn diagram of meta-model of student engagement including the atomic components of motivation and active learning**

## 4. Quantifying the meta-model of student engagement

Although the meta-model of student engagement has been completely formed (reduced to atomic components), only the qualitative relationships between the different components have been laid out. How they are quantitatively related has (potentially) been hinted at by the propositions that engagement is the *product* of motivation and active learning and that motivation is the *product* of expectancy and value. The motivations for these propositions are that they result in the following (respectively):

- if motivation and/or active learning is zero, there is no engagement
- if expectance and/or value is zero, there is no motivation

Challenging these propositions, their motivations, and their results is not being proposed. However, an alternative to the *product* relationship is proposed, provided that there is assumed to be a non-zero amount of any atomic component. Such an approach is supported by arguments that, for instance, there is no such thing as a total lack (zero amount) of motivation [4].

It is proposed that the *average* of motivation and active learning is a useful quantification for engagement, and similarly, the average of expectancy and value is a better quantification for student motivation than the product. The reason for this is simple. For example, if students are determined (by survey or similar means) to have *x* expectancy in, and place *y* value on their learning, the quantification of motivation should not be the product $x \times y$. This is because the product results in quantification for motivation that is *less* than *x and* less than *y*, the two components that make up the motivation. If as proposed, motivation is quantified as the *average* of expectation and value, the motivation will be *between* the numerical values of expectation and value. In other words a high value can compensate for lower expectancy and vice-versa. Equation 1 gives the calculated motivation $M_C$:

$$M_C = \text{avg}(v, e) \tag{1}$$

where *v* is value and *e* is expectancy.

Quantifying the degree of active learning is more difficult, as it is presented as a continuum. However, working on the basis that an overabundance of tasks that are complex compared to simple (or vice-versa) is not conducive to active learning, good active learning can be taken as a good balance of simple and complex tasks. This is of course dependent on discipline, the level of material being learned and a host of other factors, however it can still be taken that well balanced continuum results in good active learning. In the new meta-model, the calculated level of active learning, $A_C$, can be expressed as being proportional to $a$, the degree of perceived balance in the learning continuum:

$$A_C = k \times a \tag{2}$$

where $k$ is some proportionality constant. Therefore, a large $a$ results in a large $A_C$ (better calculated active learning level), and lower values represent greater imbalance (and a lower calculated active learning level). This approach provides an indirect way of determining $A$, the actual degree of active learning. When $A$ and $a$ are measured on the same normalized scale, $k = 1$, and the equation for $A_C$ becomes:

$$A_C = a \tag{3}$$

Finally, taking engagement to be the average of motivation and active learning, the quantification of the calculated student engagement $E_C$ becomes:

$$E_C = \text{avg}(M_C, A_C) \tag{4}$$

## 5. Experimental results

The purpose of this paper is to present a framework with which educators can encourage, foster or otherwise increase student engagement by directly addressing value, expectancy and active learning. Part of this objective is validating the quantification method proposed in Section 4. Here we present the results of a survey and use them as preliminary verification that the presented quantification methods are valid. A group of 107 students in various computer programming modules were presented with a survey designed to quantify their engagement, including directly measuring the components of value, expectation, motivation, and active learning (including balance thereof). Table 2 displays the questions asked, the component directly being measured and the average response. All questions were scored on a 1-10 rating scale, with 1 representing (least/lowest) and 10 (most/highest). All responses were then then normalized to be less than or equal to 1. Incomplete or otherwise corrupt responses (for instance selecting two answers for one question) were not included in the final results.

**Table 2. Survey questions directly measuring value (*v*), expectation (*e*), active learning balance (*a*), motivation (*M*) active learning level (*A*), and engagement (*E*) – lowercase metrics are atomic, uppercase can be derived from the atomic using equations 1-4, but here are directly measured**

| Component Measured (direct) | | | Response |
|---|---|---|---|
| | *v* | To what degree do you value successful completion of this module/programme? | 0.884 |
| | *e* | To what degree do you expect successful completion of this module/programme? | 0.911 |
| | *a* | What is the degree of balance in the range of tasks encountered in this module/programme? 10 represents perfect balance (best mix of simple and complex), and 1 represents no balance (entirely too simple or entirely too complex). | 0.794 |
| | *M* | To what degree are you motivated to successfully complete this module/programme? | 0.873 |
| | *A* | To what degree would you say the tasks encountered in this module/programme could be considered as “active learning”? | 0.845 |
| | *E* | To what degree would you say you are engaged in this module/programme? | 0.859 |

As a goal of the student engagement meta-model is to provide a framework which can be used to measure and increase student motivation, the end quantitative metric is the calculated student engagement, $E_C$, derived from the calculated motivation, $M_C$, and calculated degree of active learning, $A_C$. Table 3 presents these values, along with |Δ|, the absolute value of the difference (in percent) from the values *E*, *M*, and *A* directly measured in Table 2.

$M_C$ is 2.5% off the directly measured value in the survey. $A_C$ is 5.1% off the directly measured value, and $E_C$, is 1.3% off the directly measured value. However, the fact that $M_C$ was 2.5% *higher* than *M* and that $A_C$ was 5.1% *lower* than *A* is the reason that $E_C$ is 1.3% below *E*. The fact that $M_C$ was high and $A_C$ was low could be arbitrary. Taking into account the absolute value of the differences, the *maximum* |Δ| for $E_C$ is 5.8%.

**Table 3. Calculated motivation ($M_C$), active learning ($A_C$) and student engagement ($E_C$) with |Δ| the difference between the calculated and directly measured values**

| Metric | Calculated Value | \|Δ\|(%) |
|---|---|---|
| $M_C$ | 0.898 | 2.5 |
| $A_C$ | 0.794 | 5.1 |
| **$E_C$** | **0.846** | **≤ 5.8** |

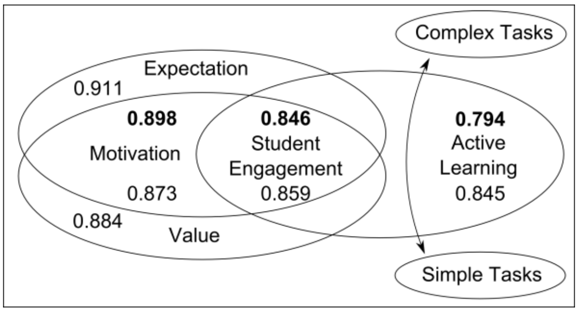


**Figure 6. Venn diagram of meta-model of student engagement showing actual survey results and calculated values (bold)**

Figure 6 shows the complete meta-model along with the directly measured values (bold), and the calculated values (italics). These results serve as indication that the presented meta-model and associated quantification are consistent with the directly measured (student perceived) reality. Of course, the *actual* student engagement is impossible to quantify. Even asking students directly is at best obtaining their *perceived* engagement, and subject to bias in survey methodology, differences in definition of terms and many other factors. Therefore a method to calculate student engagement using directly measured atomic components (expectation, value and active learning balance) over which the educator does have (some) direct control is of great importance. Further, this importance is bolstered by the fact that for these atomic components, the perceived value *is* the actual value. In other words, how much a person expects, values, or feels active learning is balanced is solely determined by the person in question, whereas motivation, active learning, and engagement are subject to perception by both the learner and the educator.

## 6. Conclusion

This paper presented a new meta-model of student engagement. As student engagement is the intersection of student motivation and active learning, it is the atomic (indivisible and therefore directly accessible and measurable) components these that are the fundamental components of student engagement.

For motivation there are two atomic components. *Expectancy* is the degree to which students expect to be able to learn successfully if they apply themselves, thus expecting to get whatever rewards that successful performance will bring. *Value* is the degree to which students value those rewards as well as the opportunity to engage in the processes involved in carrying out the learning itself.

The atomic components of active learning are mainly discipline-specific. However the simple and interdisciplinary construct of the active learning continuum allows an atomic view of active learning to be incorporated into the student engagement model, based on the perceived balance between simple and complex tasks. Interestingly the active learning continuum was originally presented as a simplified tool, "*useful for designing courses that maximize students' intellectual engagement*" [9]. This is exactly the purpose to which it is employed here.

A method of quantifying the atomic components that make up student engagement, along with simple equations to calculate student motivation, active learning level and student engagement itself was presented along with survey data that initially validates the approach. This quantification is valuable as a means of predicting student engagement based on expectancy, value and active learning balance, all things over which the educator can have some direct control, and which are (as atomic components) also directly measurable. Future work involves improving the methods of gathering data, including increasing the diversity of learners and programmes contributing to the dataset.

Using this meta-model, educators can promote, foster, and increase student engagement by addressing the directly accessible atomic components of motivation and active learning. For motivation, educators can help increase the value of student learning, and encourage having obtainable yet optimistic expectations on the outcomes of that learning. In the arena of active learning, the learning continuum can be tailored by discipline, in a manner which fosters engagement by striking the best possible balance between simple and complex tasks. Most importantly, use of the framework should be aimed at maximizing the chances that what students value, expect and actively participate in increases engagement, therefore maximizing individual achievement of the intended learning outcomes.

## 7. References


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