Interest as Emotion, as Affect, and as Schema

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The present chapter answers three questions: What is interest? Why is it important? How can teachers promote it in the classroom? To answer these questions, we find it necessary to conceptualize interest in three different ways—first as a basic emotion, second as an affect, and third as an emotion schema. As a basic emotion, interest may be understood as a coordinated feeling-purposive-expressive-bodily reaction to an opportunity to acquire new information and to learn. As a type of affect, interest may be understood as an alert, positive feeling that reflects students' underlying motivational status during instruction. As an emotion schema, interest may be understood as a complex knowledge structure that integrates interest phenomenology with cognitions such as appraisal, value, and topical knowledge. Interest is important to researchers and educators alike for two primary reasons. First, interest motivates engagement, and it motivates the type of high-quality engagement that leads to positive educational outcomes such as learning. Second, interest replenishes students' motivational and cognitive resources to the extent that interest-engaged students experience heightened vitality, rather than exhaustion, during learning activities. As to how teachers can promote students' interest in the classroom, this chapter focuses on promoting interest as a basic emotion by identifying instructional strategies designed to offer students the core antecedent to interest (i.e., opportunities to acquire new information and to learn) and on promoting interest as affect by identifying instructional strategies conducive to a constructive motivational status (e.g., involving students' psychological needs).

Interest as Emotion, as Affect, and as Schema

We begin this chapter with three questions:

- What is interest?
- Why is interest important?
- How can teachers promote interest in the classroom?

The first question asks about the very nature of interest, and we devote the first section of this chapter to the definition of interest. The second question asks about the educational utility of interest, and we devote the second section of this chapter to explaining why interest is such a vital classroom asset. The third question asks what teachers can say and do during instruction to trigger and maintain students' interest in learning activities, and we devote the third section to answering this question.

What Is Interest?

We suggest that interest, like Neapolitan ice cream, comes in three flavors. From one perspective, interest may be understood as a basic emotion. From a second perspective, interest may be understood as a type of affect. From yet a third perspective, interest may be understood as a cognitively rich emotion schema. Because it can be understood in these three different ways, interest can be defined and conceptualized in three different ways.

Interest as a Basic Emotion

Interest may be defined as a basic emotion (Izard, 2007; Silvia, 2008; Tomkins, 1962). As a basic emotion, interest exists as a coordinated feeling-purposive-expressive-bodily reaction to an important life event. In fact, all basic emotions exist as a coordinated reaction to an important life event (Ekman & Cordaro, 2011). With sadness, for instance, the important life event is loss or failure, and all students universally react to loss and failure with an aversive feeling (distress), purposive motivation (to make amends, as in apologizing or practicing harder), a distinct facial expression (inner corners of the eyebrows are raised and drawn together, corners of the lips are drawn down), and functional bodily changes (increased heart rate, lethargic muscle tone). We conceptualize interest as an emotion that

- is present at birth,
- is based in subcortical neural processes,
- is activated by a small number of specific environmental antecedents,
- is brief (lasts for seconds or minutes, rather than for a semester or a lifetime),
- remains largely unchanged throughout the lifespan (rather than something that is acquired and changed with experience),
- produces a distinct phenomenology (feeling),
- creates a desire to act in a purposive way (motivational purpose),
- produces a distinct facial expression (and distinct vocal and postural changes), and
- biologically prepares an attentive bodily orientation to the environment (arousal).

The opportunity for *new information* and *greater understanding* activates interest. The activation of interest leads students to become more familiar with, to learn about, and to better understand something new, something that can close a gap in their experience or knowledge, satisfy a need, or help expand their skills, competence, or self-concepts. Given an opportunity for new information and greater understanding, interest arises as an emotion-based feeling-purposive-expressive-bodily reaction to that opportunity. In terms of feeling, interest involves an alert, positive feeling; in terms of purpose, it creates a motivational urge to explore and to investigate; as an expression, interest widens the eyelids, parts the lips slightly, and notably stills the head; and in terms of bodily changes, it decreases heart rate. Collectively, this coordinated pattern of reactivity facilitates attention, information processing, stimulus comprehension, and learning.

Interest as Affect

A second way to understand, conceptualize, and define interest is as a type of affect. *Affect* (or *mood*) refers to students' mild, everyday, general way of feeling, as in feeling energetic versus listless and pleasant versus unpleasant (Russell, 2003). That is, affect is ever present, and it occurs within a two-dimensional feeling space. The *x*-axis represents valence (displeasure to pleasure), while the *y*-axis represents arousal (deactivation to activation). Interest affect is located in the upper right quadrant (pleasurable activation), while the other three quadrants describe calm (pleasurable deactivation), sad (displeasurable deactivation), and upset (displeasurable activation). That is, when people feel both energetic and pleasant, they say that they feel interested in what they are doing, though they sometimes use other words as well, including *excited*, *enthusiastic*, *curious*, *stimulated*, *inspired*, or *in the flow* (Csikszentmihalyi, Rathunde, & Whalen, 1993; Pekrun, Goetz, Titz, & Perry, 2002; Russell, 2003; Silvia, 2008; Watson, Clark, & Tellegen, 1988). Arousal and valance in everyday mood come from diverse sources, such as inner physiology, time of day, and personality-based individual differences, but in the classroom, these feelings come mostly from "how things are going" motivationally (Diener, Suh, Lucas, & Smith, 1999).

In math and science classrooms, students listen to lectures, participate in group discussions, read learning materials, solve problems, work on personal projects, and so forth, so their sense of "how things are going" mostly reflects their underlying motivational status while doing these things. In this sense, *motivational status* refers to the state of students' needs and goals during the flow of instruction. Things are going well when classroom events involve and are relevant to students' needs and personal strivings. Things are not going well when classroom events neglect and seem irrelevant to students' needs and goals. By this analysis, interest can be understood as an emotional signal or an affective confirmation that classroom activity is (or is not) addressing, involving, and proving itself to be relevant to a student's needs and strivings (Deci, 1992; Mouratidis, Vansteenkiste, Sideridis, & Lens, 2011). That is, interest as affect is a barometer—an affective scorecard—of how things are going in the classroom, motivationally speaking.

Interest largely reflects the activation dimension of everyday mood. A second affect that largely reflects the valence dimension is enjoyment. Reeve (1989) argued that interest is the emotional scorecard on whether classroom activity involves and is relevant to one's needs and goals; enjoyment is another emotional scorecard chronicling whether that same classroom activity satisfies and fulfills one's needs and goals. How a student's underlying motivational status ebbs and flows into felt interest and enjoyment during instruction in terms of the involvement and satisfaction (vs. neglect and frustration) of his or her psychological needs is illustrated nicely by the "person-object theory of interest" which suggests that students' motivational experiences produce differing emotional-affective levels of interest and enjoyment (Krapp, 2002, 2005). Their encounters with specific objects, events, ideas, and subject matters yield a recurring pattern of either need involvement and satisfaction on the one hand or need neglect and frustration on the other.

Consider a classroom-based example of how these two affects arise and work together. A student might be half-heartedly listening to a lecture (i.e., deactivated affect) when, suddenly, the teacher mentions a topic that is highly relevant to a psychological need or personal goal. The science teacher might say something that involves the student's psychological need for relatedness, such as the following: "Increases in the hormone oxytocin contribute to attraction, intimacy, trust, and bonding behavior. Do you know what causes oxytocin release? Touching and hugging." Relatedness need involvement makes that slice of classroom activity much more interesting than the preceding PowerPoint slide on the eight major hormones of the pituitary gland. But something else must also happen to transform the interesting moment into an enjoyable one—namely, the relatedness need must flow from activated into nurtured and satisfied. The teacher might therefore allocate some class time to small group discussion in which students discuss the credibility and relevance of such a scientific principle to their own lives (e.g., "Do you think that's right? Does touching build trust and bring people closer because of this hormone? Is oxytocin the love hormone?") When the bell rings and these students walk out the door, they are likely to say, "Class today was interesting and fun" (i.e., enjoyable). If teachers alternatively offer only need-neglecting presentation slides on the anatomy and function of the endocrine system, they are unlikely to overhear their students uttering such sentiments.

Interest as an Emotion Schema

Interest may also be understood as an emotion schema. An emotion schema is an acquired, process-oriented, highly individualized, and developmentally rich construct in which an emotion is highly intertwined with appraisals, attributions, knowledge, interpretations, and higher order cognitions such as the self-concept (Izard, 2007). The term *emotion schema* is used to connote that emotion and cognition are so intertwined and bundled together in the experience that it is difficult to tell where one ends and the other begins. For instance, cognitive appraisals of injustice, illegitimate restraint, and that "things are not what they should be" are so strongly both a cause and consequence of anger that it is difficult to tell the cognition apart from the emotion: They are so bundled together as to be one thing. In popular education–based models of interest, the cognitive states that are so tightly intertwined with interest are mostly value and topical knowledge (Alexander, 2004; Hidi & Renninger, 2006).

When interest is defined as an emotion schema, acquiring value (a sense of importance and personal meaning) in an object, event, idea, or subject matter is a developmental antecedent to high interest. Specifically, developing value and knowledge about the object, event, idea, or subject matter enables a shift from situational interest to individual interest (Hidi & Renninger, 2006). Acquiring domain-specific knowledge is another developmental antecedent to this same transition (Alexander, 2004). That interest can be acquired, changed, and developed is central to interest as an emotion schema, and from this point of view, it is the change in cognition (value, knowledge) that causes the change in interest. Thus, interest as an emotion schema changes and develops because cognition changes and develops.

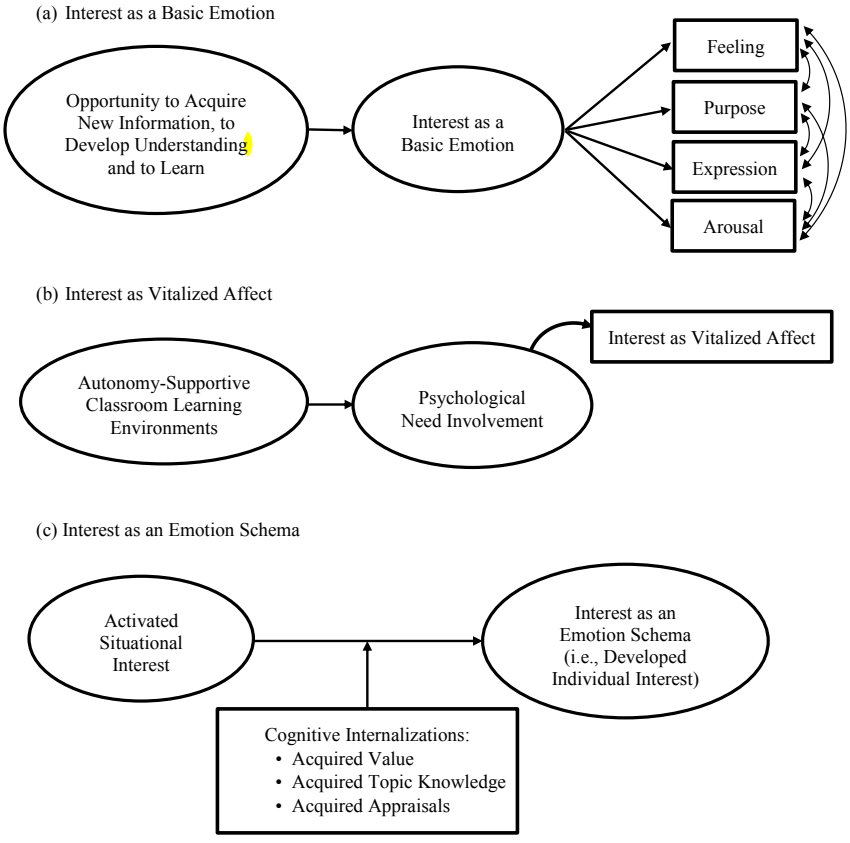

Figure 1. (a) Interest as a basic emotion, (b) interest as vitalized affect, and (c) interest as an emotion schema.

Comparing and Contrasting the Three Conceptualizations

To help clarify the three different conceptualizations (and definitions) of interest, Figure 1 offers a graphical representation to depict interest as a basic emotion (a), as an affect (b), and as an emotion schema (c). As a basic emotion, interest is activated by a specific antecedent and produces a coordinated feeling-purposive-expressive-bodily reaction. As an affect, interest is a feeling-based, experiential offshoot of psychological need involvement that comes from need-involving classroom climates (i.e., autonomy-supportive classrooms). As an emotion schema, we suggest that interest is a developmental achievement in which situational interest transitions into individual interest as students acquire supportive cognitions such as value, topical knowledge, and cognitive appraisals (and does not develop into individual interest in the absence of these supportive cognitions).

Interest as an emotion schema is a very different experience than is either interest as a basic emotion or interest as an affect. To compare and contrast these different conceptualizations, we list in Table 1 the characteristics of the interest emotion introduced at the be-

Table 1. Five Points of Contrast and Four Points of Agreement for Thinking About Interest as a Basic Emotion Versus as an Emotion Schema

Defining Characteristic	Interest as a Basic Emotion	Interest as an Emotion Schema
Five points of contrast		
Ontogeny	Present at birth	Acquired through experience
Neurological basis	Subcortical neural processes	Cortical neural processes
Activation	Narrow range of specific environmental, cognitive, and experiential antecedents	Wide range of environmental, cognitive, and experiential antecedents
Duration	Ephemeral—lasts for seconds or minutes	Enduring—lasts for a semester or a lifetime
Developmental trajectory	Remains largely unchanged throughout the lifespan	Is acquired, refined, and changed with experience
Four points of agreement		
Feeling	Alert, positive feeling	Alert, positive feeling
Purpose	Creates a motivational desire to concentrate, learn, understand	Creates a motivational desire to concentrate, learn, understand
Expression	Distinct facial expression, and distinct vocal and postural signals	No distinct facial expression, but distinct vocal and postural signals
Bodily changes	Biologically/physiologically prepares an alert, attentive environmental orientation	Biologically/physiologically prepares an alert, attentive environmental orientation

ginning of the chapter. In five important ways, interest as a basic emotion and interest as an emotion schema stand in contrast—namely, in their putative ontogeny, neural basis, means of activation, duration, and developmental trajectory. Yet, in other important ways, these conceptualizations also stand in agreement—namely, in the associated feeling, purpose, expression, and bodily changes of interest.

These conceptualizations also differ when considered as situational interest and as individual interest. Situational interest is a topic-specific and short-lived emotional state that is triggered by an external event that produces a brief attraction to that object, idea, or event (Schraw & Lehman, 2001). It is a basic emotional reaction. Individual interest is a relatively enduring disposition in which the student develops a clear preference to direct attention and effort toward a particular object, idea, event, or subject matter (Schiefele, 1999). It is a cognitively enriched emotion schema.

Why Is Interest Important?

Regardless of how it is defined, interest is important to classroom learning for two reasons. First, interest vitalizes engagement. It motivates the kind of classroom engagement that helps students translate an interest in a topic into learning about that topic. Second, interest replenishes students' motivational and cognitive resources.

Interest Motivates Engagement

Interest is a reliable predictor of positive student outcomes, such as learning, skill development, knowledge acquisition, and achievement (Renninger, Hidi, & Krapp, 1992; Schiefele, 1991; Schraw & Lehman, 2001; Silvia, 2006). Furthermore, the facilitating effect of interest on achievement has been found to generalize across different subject matters, different grade levels, and different genders (Schiefele, Krapp, & Winteler, 1992). Recent research also shows, however, that this facilitating effect is an indirect one. The classroom variable that mediates and explains the otherwise direct effect that interest has on changes in students' positive outcomes is student engagement (Buff, Reusser, Rakoczy, & Pauli, 2011; Reeve, 2013; Reeve & Tseng, 2011). These findings suggest that the direct cause of students' positive educational outcomes is the extent of their high-quality engagement in the learning activity. This in turn suggests that researchers and practitioners need to understand and appreciate student engagement at least as much as they strive to understand and appreciate student interest.

Engagement is motivated action that functions as a student-initiated pathway to positive educational outcomes (Skinner, Kindermann, & Furrer, 2009). Engagement is what students do to make academic progress. It is what students do as they try to learn, develop skill, and acquire knowledge. Engagement is a multidimensional construct consisting of three distinct yet intercorrelated and mutually supportive pathways to academic progress—namely, its behavioral, cognitive, and agentic aspects (Christenson, Reschly, & Wylie, 2012; Reeve, 2013; Skinner et al., 2009). *Behavioral engagement* refers to how involved the student is in the learning activity in terms of attention, effort, and persistence (e.g., being on task, exerting effort); *cognitive engagement* refers to how strategically the student attempts to learn in terms of using sophisticated learning strategies such as elaboration rather than superficial ones such as memorization (e.g., strategic thinking, mental simulations); and *agentic engagement* refers to students' proactive initiative to contribute constructively and transactionally into the flow of instruction they receive (expressing preferences, asking questions, and letting the teacher know what one needs, wants, and is interested in) (Reeve, 2012).

Engagement is important because it predicts and explains the extent of students' academic progress. Interest is important because it predicts and explains the extent of students' engagement. That is, activated interest increases alertness, directs attention, enhances concentration, sparks mental simulations of problem solving and strategic action, improves the recall of stored information, stimulates the use of deep and sophisticated learning strategies, enhances effort and persistence, and motivates a proactive initiative in which students seek out, investigate, and manipulate new and needed information. Stated more succinctly, activated interest motivates behavioral, cognitive, and agentic engagement.

We highlight the mediational importance of engagement here because, in the interest literature, many researchers presume that interest is the direct antecedent to students' learning and achievement. By contrast, we agree with those who study talent and skill development (Ericsson, Charness, Feltovich, & Hoffman, 2006; Ericsson, Krampe, & Tesch-Romer, 1993) that it is students' effort and persistence, their strategic thinking, and their proactive contribution into their own learning that more directly yield learning and academic

progress. This does not lessen the importance of interest, but it does help us better understand how it contributes to positive educational outcomes.

Interest Replenishes Resources

Learning requires a great deal of engagement and reengagement, and the expenditure of all this effort and concentration can be tiring. Prolonged academic engagement can exhaust students. But interest-motivated engagement is a strangely different kind of academic engagement. Recent research has found that when people engage in a learning task without the motivational support of interest, they over time typically experience a type of motivational and cognitive exhaustion that makes it harder and harder to persist and to concentrate, but when people engage in the same learning task with the motivational support of interest, they often experience a type of motivational and cognitive vitality that energizes further engagement (Thoman, Smith, & Silvia, 2011). That is, interest-fueled engagement counteracts exhaustion by replenishing—rather than by draining—motivational (e.g., capacity to persist) and cognitive (e.g., capacity to concentrate) resources.

That interest refreshes rather than drains students' motivational and cognitive resources is a pivotal educational discovery. This is because teachers have a vast number of motivational strategies to choose from as they seek to motivate their students to engage in learning activities, including offering rewards and incentives, goal setting, modeling, pep talks, scoldings, supportive learning climates, inspirational guest speakers, praise and encouragement, threats and deadlines, grading systems, social comparisons, and so on. Many of these approaches to instruction motivate and engage students, but few have the additional benefit of replenishing and energizing students. In fact, we know of only two types of motivations that replenish and energize students, and these are to induce interest (Thoman et al., 2011) and to involve psychological needs (Mouratidis et al., 2011). Interestingly, these two approaches take our discussion full circle back to thinking about interest as a basic emotion and as an affective offshoot of psychological need involvement.

How Can Teachers Promote Students' Interest in the Classroom?

Classroom implications follow from thinking about interest as a basic emotion and as a type of affect. Thinking of interest in these two ways is especially helpful to teachers because it suggests generic, one-size-fits-all instructional strategies—approaches to instruction that can be expected to benefit all students in roughly equal measure. Starting up a new video grabs the attention of all students (for the reasons listed in Table 2), not just the attention of some subset of students. This is the key reason why a basic emotion is referred to as a basic emotion—namely, because most people react to the antecedent in much the same way (e.g., feeling sad following a loss or failure) (Ekman & Cordaro, 2011).

Opportunities for new information and greater understanding are critical for learning. Ways teachers might facilitate these include offering students (a) new information; (b) new experiences (e.g., field trips); (c) new possibilities; (d) novel stories, quotations, cartoons, or jokes; (e) puzzles, riddles, or mysteries to solve; (f) suspense about what will happen next; (g) exposing a gap in existing knowledge (e.g., "I thought the answer would be *x*, but

Table 2. Three Instructional Strategies to Pique Students' Interest as a Basic Emotion

Instructional Strategy	Examples	Specific Interest-Piquing Elements of Instruction
Problem of the day	• Where did the moon come from? • What causes changes in the weather? • "Here is a problem: Calculate the volume of this cube; can you do it?"	• New information • Building suspense about what will happen next • Puzzle, riddle, or mystery to solve • Exposing a gap in one's existing knowledge • Presenting a "can you do this?" challenge
Video presentation	• YouTube selection • TED talk selection • iTunes University podcast • Educational foundation/association's selection • Educational publisher's selection	• New information • New experience • New possibility • Building suspense about what will happen next • Introducing thoughts and stories of learning, discovering, and achieving • Signaling that personal gain is imminent
Classroom demonstration	• Condensation and evaporation • Collect data on the daily snowfall in February • How to use a new tool or piece of equipment	• New information • New experience • New possibility • Fun story, cartoon, or joke • Building suspense about what will happen next • Puzzle, riddle, or mystery to solve • Exposing a gap in one's existing knowledge • Presenting a "can you do this?" challenge

it wasn't; now I'm wondering what the answer might be."); (h) an opportunity (a challenge) to stretch or expand a valued skill; (i) introducing thoughts, stories, and possibilities of discovering or achieving; (j) embedding the learning activity within a fantasy context; (k) personalizing instruction by offering opportunities for self-direction; and (l) signaling that personal gain is imminent (Berlyne, 1966; Cordova & Lepper, 1996; Izard, 1991; Loewenstein, 1994; Schraw & Lehman, 2001; Silvia, 2006, 2008). This is a long list of interest-piquing antecedents, but teachers often aggregate these specific elements of instruction into general instructional strategies, such as the three listed in Table 2.

Offering students a lesson-centric *problem of the day* is an instructional strategy to spark interest, and it is effective in doing so for the reasons listed on the right side of Table 2. For instance, presenting the problem "Where did the moon come from?" represents an instructional opportunity to expose students to new and unknown information about the solar system, to build suspense as some evidence seems to support while other evidence seems to refute a hypothesized answer, to offer an intellectual puzzle to solve, to reveal a gap in knowledge about an otherwise familiar object, and to challenge students to produce an ex-

planation that they cannot yet produce. Offering a lesson-centric video presentation (e.g., a YouTube selection) is a second effective instructional strategy to spark interest, and it is effective in doing so for the reasons listed on the right side of Table 2. Offering students a classroom demonstration is a third interest-sparking instructional strategy. For instance, a science teacher might demonstrate the principle of condensation by putting ice-cold water inside a sealed jar and waiting for water droplets to appear on the outside surface. In doing so, the teacher introduces a means to deliver into the lesson all eight interest-piquing elements listed on the right side of Table 2.

The instructional strategies listed in Table 2 represent direct ways to pique students' interest. There are indirect ways as well. Instructional strategies that tap into and involve students' psychological needs (autonomy, competence, and relatedness) address students' psychological needs directly, but they also indirectly generate interest as affect (Mouratidis et al., 2011). It is unfortunately beyond the scope of the present chapter to provide specific instructional strategies to involve students' autonomy, competence, and relatedness during instruction, but we can refer the interested reader to theoretical overviews (Reeve, 2009) and classroom examples (Cheon, Reeve, & Moon, 2012; Jang, Reeve, & Deci, 2010; Reeve, 2011; Reeve, Jang, Carrell, Jeon, & Barch, 2004) of this interest-enhancing approach to instruction.

Thinking about interest as an emotion schema offers a third way to facilitate student interest. This third way, however, is a more individualized and less generic way to pique interest, as emotion schemas involve wide individual differences, as research indicates students vary considerably in their prior knowledge, value for different subject matters, and ability beliefs (Renninger, Ewen, & Lasher, 2002).

Implications

Our conceptualizations of interest as emotion, as affect, and as schema create new opportunities to answer open questions in the interest literature (see Renninger & Su, 2012).

Question 1: What Is the Relation Between Interest in a Domain (Math, Science) and Competency-Based Beliefs?

This question has received recent attention (Fisher, Dobbs-Oates, Doctoroff, & Arnold, 2012; Sansone & Thoman, 2005). The empirical conclusion seems to be that interest and competency-based experiences (e.g., competence need satisfaction) and beliefs (e.g., perceived skill, self-efficacy, ability beliefs) are reciprocally related. That is, changes in interest (as a basic emotion) tend to produce longitudinal changes in engagement, and these changes in engagement in turn build skill and increase competence perceptions. Thus, interest leads to competence, and it does so through its facilitating effect on engagement. How changes in competence produce longitudinal changes in interest is more complicated, because the facilitating effect of competence depends on the definition of interest. For interest as a basic emotion, we would not expect competence to lead to interest, because the specific antecedent of situational interest is new information, not competency-based beliefs. But, for interest as an emotion schema, we would expect competency-based cognitions to influence interest, because these cognitions are the developmental roots that grow individual interest.

Question 2: Does the Answer to Question 1 Vary for Earlier Versus Later Phases of Interest Development?

As the question applies to situational interest and to interest as an emotion, the answer is yes. The effect of interest on competency-based beliefs is expected to be strong, as situational interest motivates engagement and hence opportunities for greater competence. This of course would be an indirect effect of interest on competency beliefs (as it is mediated by engagement). In contrast, the effect of competence on interest as a basic emotion and interest as affect is expected to be minimal, because perceived competence underlies enjoyment (and need satisfaction) rather than interest (and need involvement). As the question applies to individual interest and to interest as an emotion schema, the answer is no. Individual interest and competency-based cognitions are so intertwined and bundled together that the relation between them would be constantly reciprocal.

Question 3: What Triggers Interest? What Maintains It?

Interest as a basic emotion is triggered by an opportunity for new information and by the classroom events such as those summarized in Table 2; it is maintained by the continual resupply of similar opportunities and classroom events. Interest as affect is triggered by the involvement of one's psychological needs; it is maintained by immersion in a supportive learning environment that continuously supports the involvement of students' psychological needs and personal goals. Interest as an emotion schema is triggered by content, associations, and experiences that are highly individualized and specific to a particular object, idea, event, or subject matter; it is maintained by assimilating and accommodating new cognitions (value, knowledge, appraisals) into that existing and constantly developing knowledge structure (i.e., schema).

Question 4: What Explains Fluctuations in Interest and in Competency-Related Beliefs?

Interest as an emotion rises and falls in reaction to the availability of new information, and by the provision of classroom events such as those listed in Table 2. Interest as affect rises and falls with the involvement versus the neglect of one's psychological needs. Interest as emotion schema is relatively steady, as it exists as an enduring (yet malleable) cognitive structure that is not expected to fluctuate much from one hour or from one day to the next.

Question 5: What Supports Shifts From the Early Phases of Interest to Its Later Phases?

Interest as a basic emotion and interest as affect do not shift from one phase to another. They are situational states. Interest as an emotion schema, however, transitions from a cognitively impoverished status (little value, little topical knowledge) to a cognitively enriched and highly elaborated phase of individual interest that is characterized by high value and much knowledge.

Question 6: What Is the Role of the Differing Phases of Interest in Developing Students' Understanding of Math and Science Concepts?

Because we focus mostly on interest as a basic emotion, interest as a type of affect, and situational interest, this question does not apply. That said, we can offer the following guideline

for the instructional effort to help students better understand math and science concepts. If the instructional goal is to spark all students' interest and engagement in a 10-minute learning activity, we recommend that teachers think about interest as a basic emotion and use instructional strategies such as those in Table 2. If the instructional goal is to cultivate all students' interest in a cluster of learning activities, such as a weekly unit of information or in a semester-long subject matter, we recommend that teachers think about interest as affect and use instructional strategies that can involve students' psychological needs. If the instructional goal is to promote a developmental growth trajectory of greater interest for individual students over a relatively long period of schooling, we recommend that teachers think about interest as an emotion schema and build instruction around the internalization of the sort of cognitions that help transition situational interest into individual interest. All three of these approaches to instruction help develop students' understanding of math and science concepts, but they define and conceptualize interest in a different way to do so.

Concluding Thoughts

The present chapter sought to answer three research questions: What is interest? Why is it educationally important? How can teachers promote it? The studies reviewed to answer these questions relied on various subject matters and participants across all grade levels, from preschool through college. In answering these questions, we tried to make three points. First, interest can be understood as an emotion, as an affect, and as a cognitively rich emotion schema. Second, different antecedents activate interest as emotion, interest as affect, and interest as schema. Third, regardless of how interest is defined or activated, interest is educationally important because it motivates engagement and because it replenishes students' motivational and cognitive resources. All three points have important implications for classroom practice, but we emphasized how teachers might enliven student interest by offering and re-supplying the known antecedents of interest as a basic emotion (Table 2) and interest as affect (the alert positive feeling that arises from psychological need involvement). As to future research, we encourage four types of new data sets: neural bases of interest as a basic emotion; interest-enjoyment affective dynamics; longitudinal investigations of the developmental roots of enduring individual interests; and mediational analyses to understand whether engagement fully or only partially explains interest.

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