

Interest and Its Development

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Abstract

This chapter focuses on interest as a cognitive and affective motivational variable that develops and can be supported to develop. Interest and interest development as described by Hidi and Renninger's (2006) Four-Phase Model of Interest Development are (a) defined and then (b) contextualized in light of other conceptualizations that focus on specific aspects of interest (such as emotion, experience, task features, value, and vocational interest) and issues pertaining to the operationalization and measurement of interest. Following this, research addressing the development of interest is overviewed, with particular attention to (a) the triggering of interest in both earlier and later phases of interest, (b) maintaining interest once it has been triggered, (c) fluctuations in interest, and (d) shifts between phases in the development of interest. Finally, a Punnett square is employed to suggest next steps and open questions in the study of interest development.

Key Words: achievement, affect, interest, interest development, knowledge, metacognition, value

Introduction

This chapter overviews research that contributes to understanding interest as a cognitive and affective motivational variable that both develops and can be supported to develop. It includes studies that have been conducted in varying domains using different methods. The chapter centers on aspects of development that are not yet well understood. It begins with the case of Helen Keller and an analysis of a part of her autobiography, *The Story of My Life* (Keller, 1903).

Helen Keller was the first blind person to receive a bachelor's degree. She became a world-famous activist, wrote books about her experience and beliefs, and is now widely considered one of the most inspirational people of the 20th century. Through the support of her tutor Anne Sullivan, Helen "discovered" language, communication, and society. Helen's case, particularly as it is presented in her

autobiography, is used to illustrate critical aspects in the development of interest, the conditions that support interest to develop and deepen, with which researchers and practitioners continue to wrestle. These are elaborated on later in this chapter, starting with the initial triggering of interest through to the point where she asks questions, reflects on these, and independently follows through to seek answers and feedback. Helen's case of interest development is paraphrased briefly below:

Rendered both deaf and blind at a young age, Helen stumbled around like a feral animal for many years. The adults around her were unable to reach or tame her, pitying her and letting her do anything she wanted. When Anne Sullivan, a young and financially strapped tutor, was hired to help Helen, she found a bright but horribly spoiled 7-year-old girl who was unable to see the implications of her own behavior

and its effect on other people. Anne did not approve of the way that Helen grabbed food from various people's dinner plates and broke things during temper tantrums. Anne disciplined, and Helen fought back both physically and with pranks.

Anne recognized that Helen was bright and decided to teach her how to finger spell, thinking that this might help her to communicate with others. Anne would put an object in one of Helen's hands, and in the other quickly spell the name for the object. Even though Helen could imitate well, she did not understand what Anne was trying to teach her. Her patience ran out quickly, and the lessons would end in tears and yelling.

Everything changed one day when Anne pumped water into Helen's hands and spelled "water." The event appeared to trigger Helen to make a connection between the fluttering movement in her hand and the cold liquid spilling over her skin. All of a sudden, Helen realized what Anne had been trying to show her as she had doggedly spelled word after word into her hand all those weeks. From then on, Anne could hardly keep up with Helen, who dragged her around demanding a word for everything she encountered, everything that had been there before.

Anne's efforts to help Helen make connections between signs and what they represent could be described as potential triggers for interest, and the incident with the water was a trigger that worked because with it she discovered the connection between the sign and water. We do not know why or how the trigger of the water served as a catalyst. In fact, Helen thought at first that this was some kind of game. It seems likely that many factors contributed to her revelation.

We know, however, that a few elements of Helen's story are particularly important to the description and understanding of interest development. First, the development of her interest involved extended, seemingly ineffective, external support before she made a connection between the finger spelling and the water and then engaged the challenge of revisiting the prior lessons that had been so very frustrating to her. She did not make a decision to be interested in communication. Rather, it seems that she needed to encounter the connection in order to communicate, and it was the connection that triggered her eventual interest in communication more generally.

Second, Helen was not aware that she was developing an interest as her tutor worked with her. The potential triggers of finger spelling did not "take"

until the incident with the water. Even at that point, it is not clear that she would have described finger spelling, or communication more generally, as something in which she was personally invested and that would hold her interest.

Third, Helen's interest developed in a context where her strengths and needs were accounted for and she was not being graded or assessed: Anne worked with her so that she would understand and be able to think and explore. She was extremely successful by any number of measures, once her interest began to develop.

Fourth, Helen's interest continued to develop because, once she made the connection between finger spelling and communicating, she then had curiosity questions for which she wanted answers—curiosity questions are questions that are novel to the learner but may not be novel to others (Renninger, 2000). Finding answers to these questions led her to continue to stretch her own understanding.

Fifth, once she began asking curiosity questions, Helen also began to self-regulate and to explore and seize opportunities to learn—opportunities that were ostensibly present before but that she was not in a position to see.

It is not until Helen makes the connection between finger spelling and communication that she begins to pose her own curiosity questions, seek answers, and reflect on them—a point when her interest is clearly developing. However, as Helen's case reveals, the development of interest has phases that precede what to the outside observer would be identified as "interest." Her interest also continues to develop beyond the phase that is detailed here. The present chapter focuses on the development of interest, from the point of potential triggering that "takes" to the point when the learner begins to ask his or her own curiosity questions, and then follows through to reflect on these and seek answers.

Misunderstood Aspects of Research on Interest Development

We next call attention to two often misunderstood aspects of research on the development of interest: awareness of interest (the learner's ability to cognitively evaluate engagement), and the essential role of knowledge, in addition to feelings and value, as an indicator of interest, especially in later phases of interest development.

Awareness of Interest

As Helen's case illustrates, the development of interest does not necessarily involve metacognitive,

or reflective, awareness. This point has three implications for researchers, educators, and the learners themselves. First, learners are not necessarily dependent on their will to develop interest or be interested (Lipstein & Renninger, 2007). They may be dependent largely on supports to find ways to connect with the content that they are to learn, and while they need to make their own connections, they are also likely to need support to perceive them (Renninger, 2010). Second, while learners may make a cognitive evaluation about some content, like Helen they also may not be aware that their interest has been triggered until much later in the process of its development. In later phases of interest development too, they can be so engrossed in engagement that they are not reflecting on it.

A third implication is that having and developing an interest is not the same as being metacognitively aware of the role of interest in one's learning. The presence of metacognition impacts a learner's ability to take stock of his or her own goals and to act on them (see Flavell, 1976). In this sense, the learner's goals refer to what the learner wants to understand or do, not whether his or her goals would be considered mastery or performance goals, since a learner may possess both types of goals. Thus, while a person may or may not be aware of the process of engaging with an identified interest, the extent to which he or she is metacognitively aware of his or her interest and its role in learning is likely to impact *how*, not whether, he or she organizes as a learner and follows through to engage.

Knowledge and Interest

In its earliest phases, interest may be considered an emotion, or measured based on affect, or emotional response, and have minimal knowledge requirements (Ainley, 2007; Hidi, 2006; Reeve, Jang, Hardre, & Omura, 2002). As interest develops, knowledge and value, in addition to affect, need to be present (Renninger, 1990, 2000). More specifically, Hidi and Renninger (2006) argue that as interest develops and deepens, the desire for knowledge and value develop concurrently, while affect continues to be an important aspect of interest.

In distinguishing among the phases of interest development, content knowledge is also an important indicator. Without knowledge, a learner is not in a position to develop the types of curiosity questions that lead to reengagement, as well as the value that comes from asking these questions. Helen, for example, had no knowledge that finger spelling

allowed communication. It was only when she made this connection and began to build her knowledge that she then also had questions that she wanted to answer. This led to her continued reengagement to understand.

Defining Interest and Interest Development

In the present chapter, which focuses on interest and its potential to develop, interest is conceptualized as:

(a) referring to both a learner's state as well as his or her predisposition to return to engagement with a particular class of ideas (disciplinary content), events, or objects, and

(b) developing through four phases: triggered situational, maintained situational, emerging individual, and well-developed individual interest (see Fig. 11.1; Hidi & Renninger, 2006).

In this section of this chapter, the Four-Phase Model of Interest Development is described. This is followed by an overview of other approaches to the study of interest in order to provide a context for understanding a developmental approach. In later sections, research specific to interest development is reviewed and issues central to next steps in understanding its development are considered.

The Four-Phase Model of Interest Development

Hidi and Renninger's (2006) model identifies four phases in the development of interest based on existing empirical literature and extended previous discussions suggesting that there were two types of interest: situational and individual interest (e.g., Hidi, 1990; Krapp, Hidi, & Renninger, 1992; Renninger, 1990). Briefly, situational interest refers to the likelihood that particular content, activities, or events will trigger a response in the moment that may hold over time (Hidi & Baird, 1986; Mitchell, 1993). Individual interest, in contrast, refers to an ongoing and possible deepening of a person's relation to particular content. It includes a more enriched kind of value than situational interest, as well as an increasingly consolidated base of discourse knowledge (Renninger, 1990, 2000).

In the Four-Phase Model, Hidi and Renninger (2006) suggested that findings from studies of situational and individual interest were complementary and could be used to map the development of interest, beginning with forms of initial triggering that might be sustained to the relatively enduring predisposition to return to particular classes of content

Phases of Interest Development

Phase 1: Triggered Situational	Phase 2: Maintained Situational	Phase 3: Emerging Individual	Phase 4: Well-Developed Individual
<p>Definition</p> <ul style="list-style-type: none"> • Psychological state resulting from short-term changes in cognitive and affective processing 	<ul style="list-style-type: none"> • Psychological state that involves focused attention and persistence over extended period, and/or reoccurs and persists 	<ul style="list-style-type: none"> • Psychological state <i>and</i> the beginning of relatively enduring predisposition to seek reengagement with particular classes of content 	<ul style="list-style-type: none"> • Psychological state <i>and</i> a relatively enduring predisposition to reengage particular classes of content
<p>Learner Characteristics</p> <ul style="list-style-type: none"> • Attends to content, if only fleetingly • Needs support to engage from others and through instructional design • May experience either positive or negative feelings • May or may not be reflectively aware of the experience 	<ul style="list-style-type: none"> • Reengages content that previously triggered attention • Is supported by others to find connections among their skills, knowledge, and prior experience • Has positive feelings • Is developing knowledge of the content • Is developing a sense of the content's value 	<ul style="list-style-type: none"> • Is likely to independently re-engage content • Has curiosity questions <i>and</i> <i>that leads to seek answers</i> • Has positive feelings • Has stored knowledge and stored value • Is very focused on his or her own questions 	<ul style="list-style-type: none"> • Independently reengages content • Has curiosity questions • Self-regulates easily to reframe questions and seek answers • Has positive feelings • Can persevere through frustration and challenge in order to meet goals • Recognizes others' contributions to the discipline • Actively seeks feedback

Fig. 11.1. The four phases of interest development (Hidi & Renninger, 2006): Definitions and learner characteristics.

over time. It was suggested that situational interest could develop into individual interest, but it was also suggested that situational interest could occur simultaneously with individual interest.

As described in Figure 11.1, the four phases of interest are considered to be sequential and discrete, but as Hidi and Renninger (2006) also noted, they are phases rather than stages because the length and character of a given phase may vary among individuals based on, among other factors, experience and temperament. The first phase in the development of interest is conceptualized as being initiated by a triggered situational interest. If sustained, this first phase evolves into the second phase, maintained situational interest. The third phase of interest, emerging individual interest, may develop out of the second phase and may then lead to the fourth phase, a well-developed individual interest.

Helen's experience with finger signing provides an illustration of triggered and eventually maintained situational interest that evolved almost immediately into an emerging interest. Helen's interest was triggered it seems by the juxtaposition

of the water and the finger signing: It represented the presence of a new concept, communication. Her interest for communicating using finger spelling was maintained following the triggering provided by the water, and although she first engaged communication as a game, it began to take on meaning for her. It also led her to ask questions because she wanted to understand, marking a shift in her phase of interest. Based on what Helen tells us in her autobiography, she appears to have transitioned through the phase of maintained situational interest almost immediately, possibly because she had Anne to respond and work with her to find answers to the curiosity questions she posed, as they emerged. As her autobiography also indicates, Helen continued to want to ask questions that allowed her to develop her knowledge. Her emerging individual interest rapidly developed into a well-developed individual interest.

The example of Helen demonstrates that once interest is triggered, it can be maintained and then progress as an individual interest. Her interactions with others were critical, a characteristic of inter-

est development that is now well established (e.g., Barron, 2006; Nolen, 2007; Pasupathi & Rich, 2005). At first these interactions could be characterized as supporting the generation of her interest (e.g., Mitchell, 1993; Palmer, 2004, 2009). Later they involved the provision of information that led her to continue to stretch, engage, and explore the content of her interest (see Renninger, 2010) or to self-generate interest (Sansone, Weir, Harpster, & Morgan, 1992).

The match between the strengths and needs of the learner and available support, described by Eccles and Midgley (1989) as the stage-fit of the environment, was critical to Helen, and more generally to the development of interest. Available supports can include interactions with others, such as teachers, peers, parents, or museum personnel, and the tools that they have created (e.g., books, tasks, software, exhibits). However, the presence of supports and intended triggers does not necessarily guarantee triggering. Instead, interest appears to be both triggered and supported to develop when a task such as an assignment to set a goal for a class at the beginning of the term leads learners to find meaning for themselves (Hulleman, Durik, Schweigert, & Harackiewicz, 2008; Hulleman & Harackiewicz, 2009), or when learners are allowed or take charge of shaping class activity (Cobb & Hodge, 2004; Meyer & Turner, 2002).

When support from the learning environment is lacking (or perceived to be lacking), however, interest can fall off, go dormant, or disappear altogether (Bergin, 1999). Renninger (2000), for example, described the case of a talented chess player who ceased to continue to play chess because there was no one else to challenge him. Renninger and Lipstein (2006) also reported declines in interest when students did not perceive opportunities to connect to the work they are doing and/or for their ideas to be respected and heard. Their findings appear to be consistent with those of Kunter, Baumert, and Köller (2007) who found that within the same classroom there were students whose interest would develop and students whose interest would decrease. They observe that the development of interest is likely to be more related to students' personal experience of the classroom—for example, whether they feel they understand what is expected of them and have a teacher who is responsive and provides support for autonomy (see related discussions in Frenzel, Goetz, Pekrun, & Watt, 2010; Tsai, Kunter, Lüdtke, Trautwein, & Ryan, 2008). The stage-fit of the person to the environment has been described as supporting

feelings about the worth (the value, task interest, utility, cost) of continued engagement (e.g., Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). Whether a person is in a position to make an independent decision to reengage has also been found to impact the relation between the affective and cognitive components of interest, a relation that affects the experience of interest (Ainley, 2007; Sansone & Thoman, 2005a, b) as well as the likelihood that interest will develop and deepen (Renninger, 2000).

Although learners at all ages with varying experiences can develop new interests at any time, age also affects how and whether interest is likely to develop. Undergraduates, for example, may be able to self-generate ways in which to sustain interest in view of a task that they find boring by finding some reason that the task could be beneficial to them (e.g., Sansone, et al., 1992). This capacity is related to their metacognitive awareness of the situation (a boring task that needs to be completed) and their ability to generate strategies to address it. Conversely, younger children are more likely to generate means to continue to engage only when tasks are already of interest, although they also may be more open than older learners to trying to learn new topics or participate in new activities (Renninger, Sansone, & Smith, 2004). At about 8 to 10 years of age, they begin comparing their own capacities to those of others and then need a different form of support to persevere on tasks that they have not yet tried, or that they are aware others already do at a much more advanced level than they (Renninger, 2009).

Conceptualizations of Interest Not Specifically Focused on Development

Understanding how interest can be supported to develop is of particular concern to those who support others to learn, whether in or outside the school context. However, the conceptualization of interest as a cognitive and affective motivational variable that develops is only one of the ways in which interest is defined and studied. Krapp (2002, 2007), for example, describes interest development as a process of developing one's identity. Other conceptualizations of interest reflect a range of research questions and as a result address different aspects of the way in which a person engages (or does not engage) content to be learned. These perspectives contribute to understanding interest and its relation to learning but may not address the development of interest per se. However, each is a conceptualization on which the understanding of interest development builds.

Detailed considerations of interest can be described as focusing on emotion (e.g., Ainley, 2007; Silvia, 2006), task features and environment (e.g., Mayer, 2005; Sansone & Thoman, 2005 a, b), value (e.g., Schiefele, 2009; Wigfield et al., 2006), and vocational interest (e.g., Alexander, Johnson, Leibham, & Kelley, 2008; Holland, 1985/1997; Lent, Brown, & Hackett, 1994; see Renninger & Hidi, 2011). Briefly, conceptualizations of interest that focus on emotion are often concerned with the state of interest, rather than with interest as both a state and a predisposition to reengage particular content over time. They have determined, for example, that mood, disposition, and situation combine to influence students' affective reactions to tasks (Ainley & Patrick, 2006), and that interest may be either pleasant or unpleasant (Turner & Silvia, 2006), but little is known about whether and how the intensity and valence of affect changes with the development of interest.

Conceptualizations that have focused on interest in terms of task features or the environment have also pointed to the importance of the experience of interest to engagement. They find that interest is essential to the feelings of competence that accompany this experience and self-regulation (Sansone & Thoman, 2005 a, b), and they have indicated that interest can be distracting (e.g., Mayer, Griffith, Jurkowitz, & Rothman, 2008). However, because these approaches to interest address the state of interest in earlier phases of interest development, it is not clear whether and how the experience of interest then varies with development.

Conceptualizations that have focused on interest as value have further indicated that interest that is operationalized in terms of how much the respondent says he or she *likes* particular content will differentiate first in the expectancy value framework (Wigfield et al., 2006) and is linked to intrinsic motivation (Schiefele, 2009). In cross-sectional work with middle and high school students, Denissen, Zarrett, and Eccles (2007) reported that self-concept of ability and interest are coupled, but they also point out that when achievement is introduced, there is a higher degree of coupling between self-concept of ability and achievement than between interest and achievement. Because, however, the focus of studies of interest conceptualized in terms of value has been on an assessment of value at one point in time, little is understood about possible change in the development of interest in terms of expectancy value (see Wigfield & Cambria, 2010).

Conceptualizations that have focused on interest in terms of vocational or conceptual interest address the relation between a person's present abilities and possible occupations (e.g., Holland 1985/1997; see also Armstrong, Allison, & Rounds, 2008) or categories of children's interest engagement such as science or art (e.g., Alexander et al., 2008) and school readiness. One line of work within this framework draws on counseling psychology to suggest that environmental support can be provided to encourage those who presently lack interest to develop it (e.g., women who lack interest for engineering; Brown & Lent, 1996). Lent, Brown, and Hackett's (1994, 2000) Social Cognitive Career Theory describes interest development as determined by the individual's perceptions of his or her own competence, or ability to succeed.

Each of the conceptualizations overviewed indicates that interest can beneficially influence learning (although it can also be distracting) and that it is always linked to a particular disciplinary content, object, event, or idea. The conceptualizations also all acknowledge the role of affect, or feelings, as a component of interest, but they tend to vary in the extent to which affect, knowledge, and value are the focus of inquiry and measurement.

Some of the conceptualizations describe knowledge and value as components of interest (Ainley, 2007; Hidi & Renninger, 2006; Mayer, 2005; Sansone & Thoman, 2005 a, b; Silvia, 2006), whereas others focused on affect and value as established through cognitive evaluation (Krapp, 2005, 2007; Schiefele, 2009; Wigfield et al., 2006). Differences among the conceptualizations with respect to the role of knowledge reflect differences among research aims. The research questions being addressed do not necessarily assess change over time but instead focus on one or another aspect of interest that may be present and/or a factor in each phase of interest.

Operationalization and Measurement Considerations

There presently is no single correct measure or indicator of interest or interest development, and as Renninger and Hidi (2011) have noted, such a specification may not be possible because of differences in the structure of disciplinary domains, with some being more hierarchical than others (Lawless & Kulikowich, 2006), and/or differences in researchers' questions.

To date, interest development has been measured using both surveys (e.g., Chen, Darst, & Pangrazi, 1999; Häussler & Hoffmann, 2002;

Linnenbrink-Garcia et al., 2010; Schiefele, Krapp, Wild, & Winteler, 1993; Schraw, Bruning, & Svoboda, 1995) and behavioral measures, such as online experience sampling (Ainley, Hidi, & Berndorff, 2002), functional magnetic resonance imaging (fMRI; Kim, Lee, & Bong, 2009), or participant observation (Pressick-Kilborn & Walker, 2002; Nolen, 2007; Renninger & Wozniak, 1985). In its most well-developed form, interest has also been assessed based on participation (Azevedo, 2006; Barron, 2006; Fink, 1998) or membership (e.g., recreational figure skaters, see Green-Demers, Pelletier, Stewart, & Gushue, 1998; mathematicians, Gisbert 1998). However, Renninger, Cai, Lewis, Adams, and Ernst (2011) report that interest that is not well developed is not accurately predicted by participation alone.

While surveys capture respondent perceptions, behavioral measures capture respondent behaviors. Triangulating assessments is likely to be necessary in order to accurately capture differences among phases of interest. For example, while triggered interest may be assessed through behavioral measures, it is not likely to be easily assessed in the earlier phases of its development using self-reports alone given that respondents in this phase are often not aware that interest has been triggered. On the other hand, a respondent is in a position to report whether he or she works on more math problems than those that are assigned, suggesting that survey items that specify more developed forms of interest may be expected to provide a way to partition a sample.

Hidi and Renninger (2006) have suggested that while the earliest phases and the state of interest may be characterized and assessed by affective response, the identification of developed interest needs to account for the relation between feelings, value, and knowledge, and that change in this relation might be expected with development. Presently, efforts to distinguish phases of interest have focused on dichotomies such as situational and individual interest, earlier and later phases of interest, less developed and more developed interest, or low interest and high interest. Methods for identifying interest specific to each of the four phases of interest are presently being explored.

Two quasi-experimental studies of interest are described that suggest potential indicators of interest in each phase of development. These consider the relation among the phase of interest and other variables that describe learning and motivation, such as understanding of the discipline, goals, strategies, effort, self-efficacy, and feedback prefer-

ences. Both were mixed-method studies of middle school-age students; taken together, they suggest the need to further consider the role of the learning environment as another potential indicator of interest.

In each study, assessment of interest was based on an assessment of the feelings, value, and knowledge of participants relative to the other content, or subject matter, with which they were engaged. In the first, Lipstein and Renninger (2007) used survey items (Likert ratings and open-ended questions) and in-depth interviews to assess students' phase of interest for writing, and then developed portraits of students in each phase of interest. In the second, Renninger and Riley (in press) used participant observation notes and interviews collected at three time points during each of the 5 years to assess phase of interest. Their assessment procedures were informed by Renninger and Wozniak's (1985, see also Renninger, 1990) use of ethnographic methods to identify developed interest as including all of the following in relation to a particular class of objects, events, or ideas:

- a. more engagement relative to other engagements,
- b. voluntary return to engagement over time,
- c. the ability to engage independently, and
- d. engagement that is not simply ~~definitional~~ *exploratory*.

Lipstein and Renninger (2007) undertook their study of student writers in order to explore potential indicators of each of the four phases of interest development. They developed portraits of middle school students' interest for writing by coupling information from surveys of 172 students and follow-up in-depth interviews. Each portrait provided an exemplar or generalized characterization of a writer in a given phase of interest and described the student's wants and needs as a learner.

As depicted in the description of the closed environment of Figure 11.2, Lipstein and Renninger (2007) found that students with only a triggered situational interest were those with little knowledge of and value for writing but whose interest for writing could be triggered by the assignment of the "right" topic and/or feedback that appreciated their ideas and provided concrete suggestions for revision. Students with a maintained situational interest thought of writing in terms of rules, and they could be assisted to begin thinking like writers if they were provided with topics that were of interest to them and given supportive feedback. Students with an emerging individual interest for writing had

Phases of Interest Development

Phase 1: Triggered Situational	Phase 2: Maintained Situational	Phase 3: Emerging Individual	Phase 4: Well-Developed Individual
Learner Characteristics			
<ul style="list-style-type: none"> Attends to content, if only fleetingly Needs support to engage <ul style="list-style-type: none"> From others Through instructional design May experience either positive or negative feelings May or may not be reflectively aware of triggered interest 	<ul style="list-style-type: none"> Reengages content that previously triggered attention Is supported by others to find connections between skills, knowledge, and prior experience Has positive feelings Is developing knowledge of the content Is developing a sense of the content's value 	<ul style="list-style-type: none"> Is likely to independently re-engage content Has curiosity questions that lead to seeking answers Has positive feelings Has stored knowledge and stored value Is very focused on his/her own questions 	<ul style="list-style-type: none"> Independently reengages content Has curiosity questions Self-regulates easily to reframe questions and seek answers Has positive feelings Can persevere through frustration and challenge in order to meet goals Recognizes others' contributions to the discipline Actively seeks feedback
Needs/More Closed Learning Environment			
<ul style="list-style-type: none"> To have his/her ideas respected To feel genuinely appreciated for his/her efforts To have others understand how hard work with this content is A limited number of concrete suggestions 	<ul style="list-style-type: none"> To have his/her ideas respected To feel genuinely appreciated for efforts Support to explore his/her own ideas 	<ul style="list-style-type: none"> To have his/her ideas respected To feel genuinely appreciated for his/her efforts To feel that his/her ideas and goals are understood Feedback that enables him/her to see how goals can be more effectively met 	<ul style="list-style-type: none"> To have his/her ideas respected Information and feedback To balance his/her personal standards with more widely accepted standards in the discipline To feel that his/her ideas have been heard and understood Constructive feedback Challenge
Needs/More Open Learning Environment			
<ul style="list-style-type: none"> To have his/her ideas respected To feel genuinely appreciated for efforts made To know that he/she understands the content 	<ul style="list-style-type: none"> To have his/her ideas respected To feel genuinely appreciated for the efforts he/she has made To know what he/she has learned and what he/she still wants to learn 	<ul style="list-style-type: none"> To have his/her ideas respected To express his/her ideas Not to be told to revise present efforts To feel that this/her ideas and goals are understood To feel genuinely appreciated for his/her efforts Feedback that enables him/her to see how his/her goals were met 	<ul style="list-style-type: none"> To have his/her ideas respected Information and feedback To balance his/her personal standards with more widely accepted standards in the discipline To feel that his/her ideas have been heard and understood Constructive feedback Challenge

Fig. 11.2 Learner characteristics and needs in interest development generally, and by learning environment. Reprinted from Renninger, K. A. & Riley, K. R. (in press). Interest, cognition, and the case of L₂ and science. In Kreidler, S. (Ed). *Cognition and motivation: Forging an interdisciplinary perspective*. New York: Cambridge University Press.

begun to think of themselves as writers and were not interested in receiving feedback about either the organization or development of their writing. Students with a well-developed individual interest for writing also thought of themselves as writers, but, unlike those with an emerging individual interest, sought feedback and recognized that through feedback they could strengthen their abilities to communicate their ideas to others.

The characteristics of the learners in each of the four phases of interest suggest a preliminary set of indicators for each phase that includes information about what and how content is engaged and the forms of support that might be needed in order to enable it to develop (additional information is provided in both Lipstein & Renninger, 2007 and Renninger & Lipstein, 2006). However, Renninger and Riley's (in press) 5-year in-depth case study of inner-city participants in an out-of-school summer science workshop reveals a slightly different trajectory that they attribute to the workshops' out-of-school, nongraded context (see the description of the open environment in Fig. 11.2). The participants in the science workshops were in an environment that provided a lot of possible triggers for interest, and once their interest was maintained, it quickly shifted to being an emerging individual interest, where they sought input, readily asking and answering questions. This differed from the resistance to feedback that characterized the middle school writers identified as having an emerging individual interest, suggesting the possibility of the effects of environmental differences in constraint and opportunities for learning on the learners' interest trajectories.

Like findings reported by Frenzel et al. (2010), who studied the decline in students' interest for mathematics in three academic achievement tracks, *The* it appears ~~that~~ trajectory of interest development may be impacted by how open the environment is to inquiry, or the press of the learning environment on achievement. Such findings suggest the need to consider not only the learners' feelings, value, and knowledge as a predictor of interest development but also the role of the environment.

Research on Interest Development

Studies that track the behaviors of individuals over time and studies of learners in earlier and/or later phases of interest (also described as situational and individual, less developed and more developed, or low interest and high interest) provide our present understanding of interest development. Findings from these

two types of studies are described separately because they offer different insights. Studies that track the behaviors of individuals over time provide rich descriptive information that provides a basis for developing inductive models. Studies that have examined earlier and/or later phases of interest focus on studying one or more aspects of findings identified in more descriptive data with samples and methods that generalize.

A parsimonious selection of these studies is over-viewed with particular attention to four questions central to supporting interest development: (a) the triggering of interest in both earlier and later phases of interest, (b) how and why interest is maintained once it has been triggered, (c) fluctuations in interest, and (d) shifts between phases in the development of interest. Following this, the generative potential of thinking across studies is suggested, using articles by Frenzel et al. (2010) and Pugh et al. (2010).

Studies That Track Interest Over Time

Interest development as described in studies that have tracked individuals over time is collected through interviews with the participant and/or significant others in the participant's life, surveys and interviews, the development of portraits based on interviews or surveys and interviews, experience sampling, course enrollments, and/or observation. Analysis of these studies together describes the development of interest as primarily a sequential process that evolves through interactions with the environment.

TRIGGERS FOR INTEREST DEVELOPMENT

Findings from studies that track the development of interest over time generally describe a changing relation between affect and knowledge as interest develops. They also describe triggers for interest (in this case, triggers that actually result in interest development) as supporting the making of connections to content in earlier phases of interest and opportunities to continue to develop understanding of content in later phases. Some examples include the following: girls in earlier phases of interest who wanted to pursue hard science were triggered by their desire to get their father's approval and also by opportunities to pursue mathematics (Gisbert, 1998), children's desires to express themselves as members of a "literate community" in their classroom acted as a trigger for their interest in reading and writing (Nolen, 2007), and instructional methods in Latin that students personalized themselves were successful triggers (Renninger et al., 2004).

Changes in the relation between affect and knowledge are also referenced in later phases of development, when the interest being studied already exists. Some examples include the following: descriptions of self-initiated work with technology in which adolescents seek additional resources, create new activities, pursue structured learning, and develop mentoring/knowledge-sharing relationships (Barron, 2006); the dyslexic adolescent who uses his or her more well-developed interest as a context within which to work on reading skills needed to develop further understanding (Fink, 1998); and business students whose interests were refined with the introduction of new opportunities (Krapp & Lewalter, 2001). Once interest is triggered and a connection to content occurs, it appears to continue to be triggered as interest develops, either by other people or the environment, challenging reading materials, or the development of nuanced understanding.

SUSTAINING INTEREST, FLUCTUATIONS, AND SHIFTS BETWEEN PHASES

Studies that have examined the development of interest over time suggest that, once triggered, interest is sustained based on the availability of opportunities to continue to learn and of support to be autonomous—meaning that there is ready scaffolding available for the learner who needs it. Such opportunities (or constraints on opportunities) can take the form of finances, timing, or access (Barron, 2006, Barron, Kennedy-Martin, Takeuchi, & Fithian, 2009), although the types of support or feedback required may depend on the phase of the interest. Mismatches between the learner's phase of interest and available supports have been found to result in marginalization and lack of identification (Nolen, 2007), a decrease in feelings of competence (Azevedo, 2006), and the falling off of interest (Renninger & Lipstein, 2006). Shifts between phases of interest and the development of interest, on the other hand, have been characterized as including developing feelings of competence, the acquisition of skills and knowledge (Nolen, 2007; Lipstein & Renninger, 2007), and/or identification with the domain of interest (see Krapp, 2003, 2005).

Assessed in terms of the individual learner and his or her development over time, studies that have mapped trajectories of interest development point to the critical role of environmental supports in triggering and sustaining interest. As interest develops, the supports need to shift from helping learners to make connections to particular content to

encouraging learners to fully engage, explore, and work with the content of the interest (Renninger, 2010). The studies allow identification of recurrent patterns within the ecology of the larger learning environment (Barron, 2006) and point to indicators that warrant further study and consideration. Such patterns are descriptive and specific to a particular context. Next steps to examine the issues that are uncovered include the kind of replication and validation undertaken in studies that have targeted earlier and/or later phases of interest.

Studies of Earlier and/or Later Phases of Interest

Studies contributing to the understanding of earlier and/or later phases of interest have typically not been undertaken to address interest development, but rather to understand and/or demonstrate the impact of interest as a motivational variable. In these studies, researchers usually partition the sample of participants whom they are studying into earlier or later phases of interest based on responses to survey items, rather than studying one or more individuals over time. Some of these studies have focused on participants in a particular phase of interest, while others have compared the responses of participants in two phases. The relation between affect and cognition in these studies is not central unless connections between the findings and a model of interest development is specified, in which case the shifting, or change, from one to another phase of interest is addressed (e.g., Harackiewicz, Durik, K. Barron, Linnenbrink, & Tauer, 2008). Most often, this type of study focuses on earlier phases of interest and has measured interest in terms of affect and value, rather than knowledge. Taken together, the studies confirm the importance of the relation among achievement, feelings of competence, and the development of interest. They also suggest a potentially critical role for metacognitive awareness.

TRIGGERS FOR INTEREST DEVELOPMENT

Findings from studies addressing earlier and/or later phases of interest development have focused on (a) the impact of triggers for situational or individual interest on learning and (b) the experience of the learning environment as a contributor to interest. Both situational interest and individual interest have been found to trigger interest. Situational interest has been found to promote reading comprehension and motivation among third graders (Guthrie et al., 2006), help high school students develop positive attitudes toward science (Palmer, 2009), and

promote undergraduates' reading engagement and essay production (Flowerday, Schraw, & Stevens, 2004). Similarly, individual interest has been found to trigger learners to persevere in working with content that is complex and challenging. For example, middle school students were found to be more likely to persevere in working on math problems into which an individual interest had been inserted as a context (e.g., basketball) than problems into which content of less developed interest (e.g., football) were inserted (Renninger, Ewen, & Lasher, 2002; see also Hoffmann, 2002).

Having interest has also been described as a buffering factor that helps students to cope with unfavorable learning conditions (Katz, Assor, Kanat-Maymon, & Bereby-Meyer, 2006). For example, Tsai et al. (2008) reported that the climate of the classroom (e.g., the levels of autonomy support, controlling behaviors) influenced those with less developed interest more than those with well-developed interest. Similarly, Durik and Harackiewicz (2007) found that level of interest for math influenced the impact of catch (collative factors) and hold (situational factors that sustain interest) in an experimental manipulation of triggers for interest in solving math problems. Those with less interest for mathematics showed more interest in the collative-rich environment that provided triggers for novelty, and less interest in triggers for challenge, while those with more developed interest for mathematics were negatively affected by triggers for novelty and positively influenced by triggers for challenge.

Findings such as these suggest both that potential triggers for interest differ for learners with more and less developed interest, and the potential triggers of the learning environment may be particularly critical for those in earlier phases of interest development. They also suggest that the association between interest and experience that is independent of achievement, as is reported by Schiefele and Csikszentmihalyi (1994), is further indication that changed experience can impact interest (see also Pugh et al., 2010). However, Schiefele and Csikszentmihalyi (1995) also reported a correlation between grades and interest that, like Jacobs, Lanza, Osgood, Eccles, and Wigfield's (2002) findings, points to links between grades and valuing and contributes to the experience of interest.

Sansone and her colleagues' work suggest that interest experience reliably predicts task choice and persistence and is essential to self-regulation (e.g., Sansone & Thoman, 2005a, b). With interest the learner has a clear goal and is able to self-generate

or trigger interest for himself or herself. Thus, while present perception and values may inform present interest, the experience of interest can change through the process of triggering that is provided either by other people or situations (e.g., Hulleman et al., 2008; Mitchell, 1993; Palmer, 2009) or by individuals who are in a position to self-generate interest (e.g., by finding a reason to persevere; Sansone et al., 1992).

SUSTAINING, FLUCTUATIONS, AND SHIFTS IN INTEREST DEVELOPMENT

Studies of both earlier and later phases of interest development suggest that situational factors, challenge, and personal investment are potential triggers for sustaining interest, and they provide a basis for shifts that occur in interest development. For example, experiences in which students are led to explore and work with the everyday meaning of science concepts in new ways are designed to promote meaningfulness and sustain engagement (e.g., Mitchell, 1993; Palmer, 2004, 2009; Pugh et al., 2010). They also support learners to set goals for themselves that involve them in asking curiosity questions, reflecting on these, and seeking resources to answer them (Renninger, 2000; Renninger, Bachrach, & Posey, 2008).

Like the process of triggering interest, whether interest is sustained and continues to develop appears to be linked to learners' perceptions of their experiences, as well as their abilities to set goals for themselves and self-regulate (see Sansone & Thoman, 2005b). Harackiewicz et al.'s (2008) findings indicate, for example, that the process of triggering interest and goal adoption differs for those who come to class with an already developed interest and those who do not. They found that undergraduates with low initial interest who reported having their interest triggered were also those who experienced shifts in the development of interest, suggesting that the triggering of interest can promote mastery goals and that mastery goals can promote interest development.

Harackiewicz et al. (2008) also found, however, that the simple presence of a trigger did not predict continued interest. Rather, the triggering of interest in addition to students' final grades in the course predicted their continued interest. These findings suggest the importance of both mastery and performance goals to the development of interest (see Harackiewicz, Barron, Tauer, & Elliot, 2002; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002). Moreover, analyses to examine the relation

between interest (measured in terms of feelings and value) and background knowledge in the Harackiewicz et al. (2008) study revealed that initial interest was a particularly strong predictor of continued interest when paired with a high level of background knowledge, indicating the importance of content knowledge for interest development.

Interest that has been triggered has also been found to fluctuate, however. Consistent with the Harackiewicz et al. (Harackiewicz, Barron, Tauer, & Elliot, 2002; Harackiewicz, et al., 2008) findings, Denissen et al. (2007) found that students between 6 and 17 years of age felt competent and interested in the subjects in which they achieved and in which they perceived themselves to have ability. They also found an increase with age in the coordination of achievement, self-concept of ability, and/or interest, suggesting an increasingly influential role of student perceptions when the content with which they are working in school also reflects increases in difficulty (see Hidi & Ainley, 2008).

Repeated but not specifically examined in studies of earlier and/or later phases of interest development is the role of the learner's metacognitive awareness. Discussion has centered instead on perceptions of the environment and whether the learner responds to potential triggers or opportunities in the environment. The evidence suggests that when learner interest is triggered, it can be sustained, but if interest fluctuates this is linked to the learner's perceptions or experience of the environment.

The Harackiewicz et al. (2008) findings suggest that when undergraduates reported having a triggered situational interest, their interest developed. Harackiewicz et al. (2008) did not go on to suggest that if participants report having their interest triggered on a survey, then it also is the case that they have at least some level of metacognitive awareness and are positioned to set goals for themselves and self-regulate. This is an emergent finding of this review. One of the critiques of using surveys to assess earlier phases of interest has been that learners are not likely to know that their interest has been triggered. What the Harackiewicz et al. findings do suggest, however, is that when learners are able to report having a triggered interest, their interest then develops. This is not to say that interest cannot develop without this reflective awareness, but rather that interest can be expected to develop if this reflective awareness is present. Without metacognitive awareness, it may be that the learner can be supported to engage with content but may lack self-direction and need additional support to reflect on and continue to explore it.

Two Studies of Interest Development

Reviewing articles and chapters for this chapter called attention to the range of studies that contribute to our present understanding of interest development. It also pointed to the importance of their complementarities as sources of validation and emergent insight. In this section of this chapter, the questions, methods, and findings from two solid and seemingly different studies by Frenzel et al. (2010) and Pugh et al. (2010) are reviewed, and their joint contributions to interest development are considered. Two other studies could as easily have been selected for consideration; our choice was informed by the differences of their methods and the similarity of the age group that each addressed.

Frenzel et al.'s study is a quantitative longitudinal study of early adolescents' mathematics interest; Pugh et al.'s is a short-term qualitative study of high school students' transformative experiences with biology. Both studies assess the trajectory of interest development. Whereas Frenzel et al.'s study implies that the students' environment (e.g., teachers, parents, school) may influence and account for differences in their achievements and interest trajectories, Pugh et al.'s study suggests that individual learner characteristics contribute significantly to interest development. Together, these studies can be understood to suggest that interest development involves both internal and external factors and point to potential indicators and questions that the research on interest development still needs to address.

FRENZEL, GOETZ, PEKRUN, AND WATT (2010)

Frenzel et al. (2010) reported on a longitudinal study of the mathematical interests of 3,193 students (51% female) in grades 5 to 9 in the German school system based on surveys administered to the students and their parents. Using Likert scales assessing feelings and value to measure interest, the researchers addressed ~~four~~ ^{and knowledge} ~~issues~~ ^{four issues were}: (a) the characteristics of trajectories of interest development in mathematics, (b) the role of gender in the development of interest ⁱⁿ mathematics, (c) the role of ability grouping in the development of interest ^{in mathematics} development, and (d) the role of the values of significant others in the development of interest ⁱⁿ mathematics.

Frenzel et al. predicted that students would experience a generalized loss of interest across time. In particular, they hypothesized that students' intrinsic motivations for learning were likely to be in increasing conflict with school-ordained restrictions such as required courses, increased task complexity, and demands for academic effort and achievement.

Frenzel et al. focused on mathematics, noting that mathematics has long been considered a field preferred by males, and predicted that gender would influence the level of mathematics interest, in that females would have less interest than males, but that the level of female and male interest would not impact the expected decline in the trajectory of interest development given findings suggesting gender differences in the level of interest but not in the trajectory of its development (Fredricks & Eccles, 2002; Jacobs et al., 2002; Watt, 2004).

Frenzel et al. also predicted that ability grouping would impact interest development based on Marsh's (1987) findings from a study of the "Big Fish Little Pond Effect," which suggests negative effects for students placed into high-achievement groups and positive effects of placement into low-achievement groups. Taking advantage of the organization of the German school system, which tests and places students into one of three academic tracks based on academic achievement by the fourth grade, Frenzel et al. posited that students in *Hauptschule* (the lowest track) would report higher interest levels than students in either *Realschule* (the middle track) or *Gymnasium* (the highest track), due to the pressure in *Realschule* and *Gymnasium* to focus on achievement instead of personal development.

Finally, based on the findings of social cognitive theorists (e.g., Eccles, Wigfield, Harold, & Blumenfeld, 1993; Pekrun, 2000), Frenzel et al. predicted that significant others such as family, classmates/peers, and teachers would influence the formation of students' values and interest for mathematics. Family members, especially parents, have been found to be role models for their children's eventual interests and educational values (Jacobs, Davis-Kean, Bleeker, Eccles, & Malanchuk, 2005) and students can be expected to develop interests and values similar to those of their parents (Jacobs & Eccles, 2000).

Findings from Frenzel et al.'s study revealed an overall decline in mathematical interest over time, regardless of variables such as gender. In terms of gender, Frenzel et al. reported that girls had a lower initial level of interest, but as expected: There were no differences between the shapes of the trajectories of girls boys, suggesting that the areas of decline and stabilization on the growth trajectories may be the result of an intensification at earlier ages. In addition, differences were identified in the level of interest of students in each of the different ability groups. General/universal longitudinal interest declines aside, students in *Hauptschule* in grade 5 had

slightly lower initial levels of interest but by grade 9 had managed to sustain interest, whereas students in both *Realschule* and *Gymnasium* evinced steeper declines in interest levels, leveling out at a lower level than *Hauptschule* students by grade 9. Finally, while family, peer, and teacher influences affected the formation of students' interest, it appears that, based on an assessment of interest trajectories, they did not influence the development of interest.

PUGH, LINNENBRINK-GARCIA, KOSKEY, STEWART, AND MANZY (2010)

Pugh et al. (2010) reported on a short-term study of transformative experience among 166 (66% female) 9th- and 10th-grade biology students, where transformative experience is characterized by "motivated use, expansion of perception, and experiential value" (p. 7), and interest and task value are described as supporting conceptual change (Dole & Sinatra, 1998). Prestudy, poststudy, and follow-up assessments of students' science knowledge, identity, and goals were undertaken using survey data. Interest was not assessed independently but as part of the construct of experiential value; Likert-items were used to assess student opinion about the value and utility of information about natural selection.

Pugh et al.'s research questions focused on three issues: (a) the prevalence of transformative experiences among high school biology students learning about natural selection; (b) the relation among transformative experience, science identity, and mastery goal orientation; and (c) the relation between transformative experience and both initial and enduring conceptual change and transfer. Based on findings from his earlier work, Pugh (2004) had described transformative experiences as occurring when students are motivated to apply what they have learned in the classroom outside of the classroom, experiences that led to expanded perception and value. These findings suggested that transformation is best measured by observing changes in students' conceptual understandings of science and whether they *transfer* their learning to other aspects of their lives, see aspects of the world in new ways, and find value in doing so (Pugh, 2004). Like findings from Girod, Twyman, and Wojcikiewicz's (2010) work with fifth graders, Pugh (2002) showed that biology students who had transformative experiences had more gains in conceptual understanding than those who did not. In the study examined here, he and his colleagues sought to explore transformative experiences in an expanded sample and sought to explore science identity and achievement goal orientation as

predictors of transformative experience. They chose to focus on natural selection in the biology classroom because this is a topic about which students often have misconceptions.

Based on both Girod and Wong (2002) and Pugh (2004), it was expected that students who identified as having had transformative experiences were also those who saw the relevance of the science being taught. They conceptualized interest in this context in terms of value, and science identity as comprised of one's prior knowledge and one's identification with science as a strength or weakness. When students believed that they had a strong science identity, it was expected that they would thus see the relevance of the science unit being taught and were more likely to undergo transformative experiences (Girod & Wong, 2002; Pugh, 2004). Similarly, it was expected that a student's achievement goal orientation would affect the likelihood of transformative experiences.

Thus, Pugh et al. predicted that students with a mastery goal orientation would be more likely to report transformative experiences, given the focus of mastery goal orientation on learning. Pugh et al. also expected that students who either strongly identify with science or have a mastery approach toward learning would be more likely to experience transformative experiences than those with a less defined science identity and a performance approach (i.e., displaying competence but not necessarily comprehension).

Pugh and his colleagues found that both science identity and mastery goal orientations were positively associated with transformative experience. Students who both identified with science and had a mastery approach to learning were more likely to experience transformative experiences; they retained information and were able to independently apply it outside of the classroom. However, students with initially higher levels of knowledge about the information taught in the unit also reported having more transformative experiences, suggesting that the acquisition and development of knowledge and interest (defined as value and utility) may be mutually reinforcing.

Their results further suggested that students with a mastery goal orientation were more likely to report experiencing transformative experiences, and that mastery goal orientation mediated the relationship between science identity and transformative experience when prior science knowledge related to the unit taught was controlled. In other words, a strong science identity predicted a stronger endorsement

of goal orientation, which in turn predicted the occurrence of transformative experiences. It appears that mastery orientation increased the likelihood of transformative experiences. On the strength of these findings, Pugh et al. pointed to the role of individual characteristics in the development of interest.

COMPLEMENTARY ASPECTS OF THE FRENZEL ET AL. AND PUGH ET AL. STUDIES

The findings of the Frenzel et al. and Pugh et al. studies mirror and extend present discussions of interest development. Together, their findings suggest that, at least for adolescents, interest develops in relation to both academic and personal satisfaction, and the keys to these lie in the balance and personalizing of external and internal, environmental and individual, factors.

Frenzel et al.'s findings confirm the existence of a general decline of interest over time spent within the academic system, and the influence of ability groups on students' interest development. Students in Hauptschule (the lower track) showed less steep declines in interest over time, compared to students in Realschule and Gymnasium. Frenzel et al. suggested that this might be a result of the less competitive atmosphere with fewer achievement-oriented demands in Hauptschule as compared to Realschule and Gymnasium. These findings also underscore the role of the learning environment as a support for (or constraint on) academic development, interest, and performance.

Similarly, Pugh et al.'s findings point to the importance of the learning environment as a support for comprehension and transfer, suggesting the further need to attend to the role of learner characteristics in the development of interest. When prior knowledge was controlled, students with a mastery approach to learning were found to have more comprehension and a greater ability to retain and transfer what they had learned to other aspects of their lives. These findings further suggest that a mastery goal orientation may compensate for less than ideal situational factors such as unsupportive environments, limited opportunities, and grade-oriented pressure. It also appears that whether interest develops depends on the learner: It may be the individual's approach to learning that most influences both comprehension and transfer.

Frenzel et al.'s and Pugh et al.'s studies also indicated that both situational and individual factors can result in a falling off of interest. According to the Frenzel et al. study, placement into a high-achievement ability group negatively influenced

interest development, whereas placement in a low-achievement ability group had a positive effect. The interest levels of *Hauptschule* students declined at a slower rate than *Realschule* or *Gymnasium* students and eventually stabilized toward the later grades of high school. As this difference in decline in interest occurred regardless of the student's initial interest level, it suggests that the right combination of environmental factors and amount of external pressure can cause someone's interest to change, whether positively or negatively. Similarly, Pugh et al. found that intrinsic motivation, such as a mastery goal orientation, increased the likelihood of transformative experiences, more advanced conceptual understanding, and the transfer of learning.

KNOWLEDGE, A COMPONENT OF DEVELOPING INTEREST

Pugh et al.'s decision to assess interest using items addressing feelings and value (e.g., "During science class, I think the stuff we are learning about adaptation and/or natural selection is interesting." [p. 22]) and to control for prior knowledge influences what they can say about interest development. If interest develops through phases, and if transitions between phases of interest are dependent on developing understanding, then knowledge needs to be included in measures intended to distinguish between earlier and later phases of interest development. Pugh et al.'s findings provide information about the roles of knowledge and value in the process of making connections to content to be learned. However, their findings do not for sure address differences between those in earlier and later phases of interest, and their abilities to pose questions, seek answers, and so forth. While some participants may well have been in later phases of interest, distinguishing among students in terms of the possibility that some were in later phases of interest was not undertaken. Frenzel et al., on the other hand, used items to assess interest that tapped feelings and value, as well as the participants' relation to knowledge: "I would like to find out more about some of the things we deal with in our mathematics class." And, "I like to read books and solve brainteasers related to mathematics." (p. 532)

While both Pugh et al. and Frenzel et al. described their studies of interest in terms of low and high interest, the relation between their outcomes and interest theory suggest that what they are each describing differs. Pugh et al. appear to be describing either earlier and later phases of situational interest (triggered situational and maintained situational), or

an earlier phase, consisting of triggered situational and maintained situational interest, and a later phase of emerging individual interest (see Fig. 11.1). Whereas, because they have included knowledge in their assessment of interest, Frenzel et al. appear to be distinguishing between earlier and later phases of interest for mathematics.

Consistent with descriptions of students in earlier phases of interest as mapped by Lipstein and Renninger (2007; see also Renninger & Riley, in press), the Pugh et al. and the Frenzel et al. studies suggest that it is the student who ultimately makes use of available supports, and whether students make this choice depends on whether they are enabled to make personalized, individualized connections to content that is a function of both their learning characteristics and the learning environment. This is an important point. While personalized content has for some time been recognized as important in generating interest (e.g., Mitchell, 1993), the findings from the Pugh et al. and Frenzel et al. studies point to the fact that it is the learner, not the teacher or the researcher, who decides what is meaningful—and also that this is the case whether interest is in earlier or later phases of development. In other words, whether the student is positioned to take advantage of available resources may have to do with how and whether he or she understands the situation or the goal and his or her ability to recognize the utility of the particular resources or practices that would allow the goal to be realized. These findings further suggest that the degree to which the learner is metacognitively aware of his or her interest may be a critical indicator of interest development. Having an interest is not the same as being metacognitively aware of the role of interest in one's learning. Metacognition should allow for the possibility of change by enabling goal setting and self-regulation.

Conclusions

The studies by Frenzel et al. and Pugh et al. point to some potentially critical aspects and indicators of interest development, in particular the roles of situational influences such as the achievement demands of the learning environment and experiential valuing. Like the other studies of earlier and/or later phases of interest development, they note the role of the learner's metacognitive awareness as an indicator of what types of supports might be needed in order for interest to develop.

These aspects of interest development together form the basis of an inductive model for understanding the relation among the learner's phase of

interest, achievement demands of the learning environment, and metacognitive awareness. Depicted in Figure 11.3 as a Punnett square, phase of interest forms one dimension and the achievement demands of the learning environment the other. The level of the learner's metacognition, or reflective ability to think about interest and learning, is also included in each quadrant. Framed in this way, it appears that metacognitive awareness, both in terms of reflection of content and on his or her self-regulation of engagement, benefits the learner and supports his or her interest to develop. Development of content knowledge can also support the learner's capacity to develop meaningful connections to the content, regardless of his or her initial phase of interest. However, the achievement demands of the learning environment may positively or negatively affect the learner's ability to make connections to the content and ask curiosity questions about it. If the learner is negatively affected, his or her content knowledge may develop but interest may not, thereby compromising his or her possibilities for learning.

is beneficial to the learner's abilities to reflect on engagement, benefits the learner and supports his or her interest to develop.

To date, research on interest development has tended to focus on one or another aspect of inter-

est and/or its development, using different measures and methods, and resulting in seemingly contradictory findings and conclusions between studies. It appears that for research on interest development it is important to look for complementarities among findings—a consideration that also requires attention to the way in which interest and its development is conceptualized and measured, how it is studied, with which populations (age and experience), and in what type of context (domain of study, achievement expectations, etc.).

The proposed Punnett square anchors the repeated evidence that interest develops through the interaction of the learner's individual learning characteristics and his or her environment. It includes information about a particular aspect of the learning environment: its achievement demands. It also calls attention to the emergent finding from the literature review in this chapter, which suggests that metacognitive awareness contributes to whether a learner responds to potential triggers. The Punnett square can also be used to describe the focus of support needed to enable shifts in interest development. Vertical movement along the Punnett square

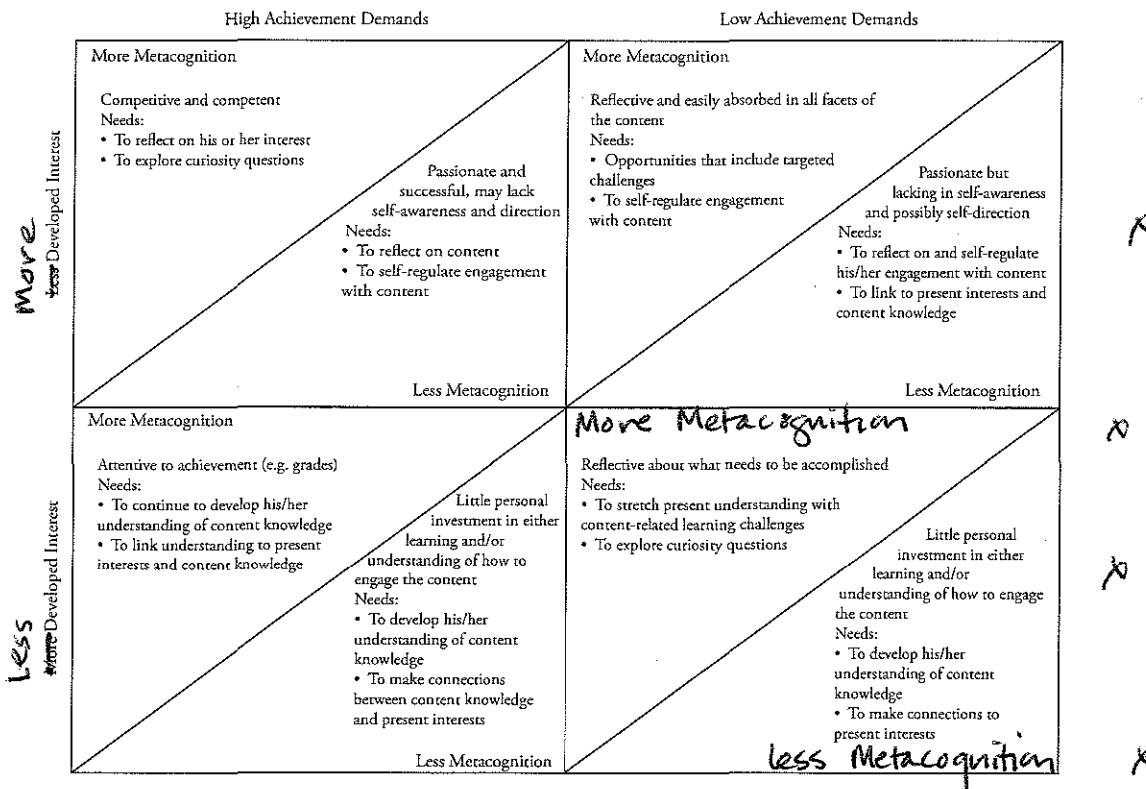


Fig. 11.3. Punnett square of the possible relations among learner phase of interest, metacognitive abilities, and achievement demands of the learning environment.

indicate shifts between earlier and later phases of interest, whereas horizontal movement refers to altering the learning environment, or achievement context.

Used for the purpose of revisiting findings from both studies of interest development over time and the studies of earlier and/or later phases in interest development, the Punnnett square facilitates the discerning of patterns among individuals sharing trajectories of interest development. Patterns such as these are useful for researchers studying interest development, and for educators or anyone working with and hoping to support the interest development of others.

Mapping what we know of Helen's experience to the Punnnett square, for example, suggests that her achievement demands were low. She was in an earlier phase of interest development at the beginning of her anecdote: She was less metacognitively aware and was unresponsive to potential triggers for interest. She then shifted from being less metacognitively aware and less developed in her interest to being more metacognitively aware and more developed in her interest.

Helen's interest developed outside of the school environment; it could be said to have been a context with low achievement demands, and that Anne, her tutor, provided appropriate types of support in order to allow her interest to develop. Based on Helen's account, she appears to have almost skipped through the phase of maintained situational interest once she made the connection between finger signing and the water, suggesting that maybe the maintaining of interest is an artifact of school-based learning, an interpretation that is suggested by the Renninger and Riley (in press) study as well. Reflecting on Helen's case, and the overviews of the literature provided, it is also noted that Helen is significantly younger than the adolescent learners of the Pugh et al. and Frenzel et al. studies, which suggests that for her, the development of this interest was possibly easier than it might have been for an older, more self-conscious student (see Renninger, 2009).

Further questions to be considered on the basis of the quadrants of the Punnnett square in Figure 11.3 include the following: whether Helen's age changes the trajectory of interest development in some way; what difference a high achievement demand context would contribute to what is understood presently; and the particulars of her engagement with both less and more metacognitive awareness (her response to potential triggers, how and why she reacted to them,

and the focus and quality of supports that enabled shifts in her interest development).

Future Directions

Research on interest has demonstrated that it is a variable that develops over time and can be supported to develop at any age. Its presence has been repeatedly found to positively impact learners' attention, goal setting, and learning. Research on interest development, however, is in its infancy. This chapter has examined research on interest and its development, paying particular attention to little understood aspects of the development of interest: the triggering of interest in both earlier and later phases of interest, how interest is maintained once it is triggered, fluctuations in the development of interest, and shifts from one to another phase of interest development.

It is provocative, for example, that interest should be able to be sustained once a respondent can indicate that his or her interest is triggered. This finding also raises other questions, however. For example: Why and when is a potential trigger likely to come to the attention of a learner and work? Are potential triggers for interest the same in all disciplinary contexts, in naturally occurring and experimental contexts? Do potential triggers (e.g., novelty) hold the same meaning for learners in one versus another phase of interest and at different ages?

Similarly, findings suggesting that fluctuations in interest are likely to be due to the learners' perceptions or experience of the environment are critical and raise questions for further study. For example: Are there particular learner characteristics, or configurations of learner characteristics, that contribute to how the environment is perceived, experienced, and whether interest can be expected to develop? What types of environmental supports are needed for learners in different phases of interest? What is the role of metacognition in the development of interest and how might it be fostered?

In the present chapter we worked with aspects and dimensions of interest development that emerged in reviewing the research literature. Any number of Punnnett squares could have been developed, drawing on already existing studies. Little research has yet been done on how findings from different studies interact with one another and/or contribute to interest development. The Punnnett square proposed in this chapter is an example of a framework that could support the continued examination of complementarities among interest research. In selecting studies to examine, we

strove to find complementarities, recognizing that differences of measures, methods, and disciplines provide insight and also present particular challenges. We suggest that forward progress in the understanding of interest and its development involves revisiting the differences and challenges of what has already been found.

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