The influence of student learning characteristics on progress through the Extended Essay, a component of the International Baccalaureate Diploma Programme[1]

John Munro University of Melbourne

Abstract The Extended Essay in the International Baccalaureate provides the opportunity for students to engage in self directed knowledge enhancement. The present study investigates the influence of three learning factors on achievement outcomes; students' approach to learning, motivational style and cognitive style. All factors affected achievement scores. The implications of their influence for instruction, for student knowledge of how to work through the Extended Essay and for assisting students to manage and direct their learning most efficiently are discussed.

A key competence in a knowledge-based society is the capacity to convert information to knowledge, to change or enhance it and to use and display this change in knowledge in a range of ways. The Extended Essay in the International Baccalaureate Diploma Programme provides a unique opportunity for students to develop directly an understanding of and a positive disposition to knowledge change and the processes involved in information - knowledge conversion.

Successful completion of the Extended Essay requires students to research critically a specific topic or issue and to communicate the outcomes of the research in a coherent way (IBO, 2002). This in turn demands the co-ordinated use of a range of information processing and learning strategies, attitudes to learning and beliefs about how the conversion of information to knowledge can be implemented. This type of activity requires students to have motives or intentions for learning, to think innovatively about a topic or issue, to frame up questions and to work through them. They need to demonstrate information literacy, for example, to align information with their existing knowledge, to use it selectively for specific purposes, to organise and prioritise it, to evaluate it from a number of perspectives and to infer from it. They also need to display intermediate outcomes of this investigation, to use feedback to modify their understanding and to align their change in knowledge with specified assessment parameters.

The Extended Essay, then, has the potential to help students learn generic strategies for self direction and management as knowledge generators. The importance of self-regulated learning as a "pivotal construct in contemporary accounts of effective academic learning" (Pintrich, 1995, p. 173) is increasingly acknowledged. Self-regulated students are metacognitively and motivationally active in their learning and are confident, autonomous, inquisitive learners.

Learning strategies play a role in optimising academic performance (Purdie and Hattie, 1996); higher achievers report a greater use of most strategies than lower achieving students (Pintrich & Schrauben 1992), although these strategies may vary among students (Ablard & Lipschultz, 1998). Their use is necessary, but insufficient to enhance academic performance. Motivational components operate with them (Zimmerman, 1990) such that learners' beliefs about the likelihood of success affects their degree of self-regulation by influencing the learning strategies they use (Pintrich and Garcia, 1991; Schunk, 1990, 1991; Zimmerman & Martinez-Pons, 1990).

The concept of academic self-regulation has particular relevance for the Extended Essay. For its satisfactory completion, students need to manage their study schedules and how they approach learning and studying. Students who learn to control their learning are more able to balance these demands with competing activities (Zimmerman, Greenberg, & Weinstein, 1994).

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This research examines the influence of a number of learning factors on successful completion of the Extended Essay. Three key aspects of self regulated learning are explored; students' approach to learning, their motivation to achieve academically and their cognitive style. It is assumed that the three variables operate interactively during self regulated learning.

Approach to learning There are three main approaches to learning (Ramsden, 1984; Biggs, 1987), each with two dimensions; a motive for learning and a set of learning strategies. The three types of motive for learning are (1) to increase one's knowledge of a topic (a 'deep' motive), (2) to retain knowledge to meet a criterion unrelated to the idea (a 'surface' motive) and (3) to achieve understanding at a level relative to others, (an 'achieving' motive). The first motive is driven by personal interest, the second by meeting a criterion with a minimum of investment of effort and the third by an interest in meeting external criteria at the highest level.

Each motive has a linked set of learning strategies that describe how the learner acts on the knowledge. The deep approach involves students focusing on the underlying meaning of a topic, searching actively for meaning, questioning ideas to understand them better, linking them with what they know, taking them apart, looking at them from different perspectives and applying them in unfamiliar situations (Biggs, 1987; Ramsden, 1984). The surface approach involves learners focusing on the superficial features of a topic, learning and memorizing them in an unquestioning way so they can be reproduced later. The achieving approach focuses on learners organising or structuring knowledge of a topic in the most efficient way (managing time commitments, working space) with the purpose of optimising assessment grades or meeting other external criteria. The use of deep learning strategies over surface learning strategies is associated with higher academic performance in research in medicine (McManus, Richards and Winder; 1999).

Completion of the Extended Essay requires the use of the three approaches at various times. The deep approach delivers higher order outcomes, in-depth analyses and novel syntheses, creativity, efficiency in organising knowledge and aligning bodies of knowledge (Biggs, 1989; Morgan, Dingsdag & Saenger, 1998). The achieving approach assists learners to align what they know with external criteria, establish action plans, use information sources effectively and monitor progress. Surface approaches assist in short term retention of information and applying conventions (Hounsell, 1997).

The Extended Essay requires the management of independent study. Because of their comparative inefficiency, the use of surface strategies takes longer than deep strategies for processing a given information source (Kember and Gow, 1991). Deep strategies permit the rapid identification of key ideas in a source and the use of relevant existing knowledge as a scaffold. Students using surface strategies are less likely to search for unifying principles and take longer to match a body of information with what they know than students using deep strategies.

Learners' existing knowledge A second dimension of learning relates to the learner's existing knowledge, its organisation and how it is used during information processing. What and how learners know provides a base for the questions they ask, their capacity to organise and integrate the information accessed, how they convert it to knowledge and display the outcomes.

One description of the use of existing knowledge during learning is in terms of cognitive style theory. This approach assumes that individuals learn in different ways and that they display a cognitive consistency over time and situations in how they learn. One's cognitive style is an abstraction of how one thinks and learns, that is, the information processing preferences used. The plethora of cognitive styles identified can be grouped into two dimensions (Riding & Cheema, 1991) describing how a person (1) codes or represents information and (2) processes or manipulates the information. The present study examines task completion in terms of these dimensions.

Preferences for representing or coding information are described in terms of a continuum, the imagery - verbal dimension. The imagery code links ideas in terms of real-life contexts and experiences, while the verbal code links ideas in decontextualised abstract ways without reference to real life contexts. Other names for this dimension are the verbaliser - visualiser distinction (Riding & Cheema, 1991) and the active experimentation - reflective observation distinction (Kolb, 1984).

Preferences for manipulating information are described in terms of the analytic - global dimension. Analytic strategies focus on parts of information and the order among them. Global strategies focus on linking whole ideas and work at the 'big picture level'. Other names for this dimension include the independence - field dependence dimension, the reflectivity -impulsivity dimension, the convergent - divergent dimension, the sharpener-leveler dimension, the serial - global dimension and the sequential- random dimension (Riding & Cheema, 1991).

The cognitive style approach is seen as a useful procedure for investigating the use of existing knowledge during completion of the Extended Essay across a range of subject or domain areas because it focuses on the organisation of knowledge rather than on the specific content. It facilitates analysis of the use of existing knowledge to process information regardless of the topic. Although the two dimensional model of cognitive style is a simplification, the four types of learning strategies, global imagery, analytic imagery, global verbal and analytic verbal provide a framework for examining learning.

Completion of the Extended Essay is assumed to require the use of the four types of strategies at various times. Verbal encoding is necessary for comprehending verbal information sources, for thinking in linguistic propositions and for displaying knowledge in linguistic ways. Imagery encoding assists in thinking creatively, in exploring ideas in novel contexts and in integrating novel ideas. Global strategies facilitate 'big picture' thinking, the synthesis of ideas and lateral thinking. Analytic strategies facilitate the analysis of ideas at the detail level, the logical sequencing of ideas, the linking of parts and wholes, the prioritising of parts of topics and the learning of conventions.

Motivation to learn Effective learning, as noted above, involves the ability to self-regulate a range of cognitive and metacognitive strategies (Schunk, 1991; Zimmerman, 1990). Strategy activation and transfer are managed by a set of motivational variables (Meece, Blumenfeld, & Hoyle, 1988) such that students' level of cognitive engagement depends on motivational and cognitive factors working in synchrony (Pintrich & Schrauben, 1992). Their motivational goals and their purposes for learning influence the quality of the learning and the achievement (Pintrich & Schrauben, 1992).

Motivation is the process by which goal directed behaviour is instigated and sustained (Schunk, 1990). Students are motivated to learn when they are prepared to engage their existing knowledge and activate learning strategies. Two generic types of motivation to learn have been identified (Deci & Ryan, 1985); learning that is internally driven, that is, intrinsic motivation, and learning that is externally driven, that is, extrinsic motivation. The two types of motivation are mediated by different perceptions; learners are extrinsically motivated when they learn for purposes that are external to the change in knowledge, when the learning is a means to an end. Learners are intrinsically motivated when they learn because of a desire to know more about a set of ideas. Intrinsic motivation involves the integration of two self-perceptions; self-confidence and self-management. If neither of these conditions is in the learning context, intrinsically motivated learning is less likely.

It is reasonable to expect that students completing the Extended Essay need to balance the use of both types of motivation. While intrinsic motivation would intuitively seem to be the more useful (Spaulding, 1993), there are times when the conditions of perceived self-competence and self-determination are not immediately the most appropriate. Teachers supervising the Extended Essay need to be aware of this balance and the need to avoid using extrinsic procedures when students display intrinsic motivation. Substantial research has shown that when teachers implement extrinsic motivational schedules for students who are intrinsically motivated to achieve a goal, students' level of intrinsic motivation and their beliefs about their ability for self control and competence are lowered (Deci & Ryan, 1985; Spaulding, 1993). There will, on the other hand, be occasions when careful use of extrinsic procedures will increase intrinsic motivation, for example, praise that supports learners in their pursuit of knowledge.

The motivational patterns students implement depends on the learning goals they believe are valued. Linked with each type of motivation are goals that specify the types of learning outcomes that are to be targeted. Two types of achievement goals have been identified.

Mastery goals are linked with intrinsic motivation. They focus on learning more about a topic, improving understanding or competence and developing self-referenced standards. They foster self-

regulated behaviours, positive attributional beliefs such as *The harder I work the more I'll learn, When I fail I can change how I am learning,* a preference for challenging work and risk taking, and positive engagement with tasks. Performance goals are linked with extrinsic motivation. They focus on social comparison standards, that is, 'doing better than others', learning so that outcomes can be displayed publicly. They are more likely to foster negative attributional beliefs such as *I need to win as quickly as possible,* an avoidance of challenging tasks and a preference for quick, short -term confirmatory outcomes and small tasks.

Assessing knowledge enhancement; generic and domain specific criteria process

Knowledge enhancement processes can be examined from two complementary perspectives; those that are generic across a range of content areas and those that are more specific to a particular content area or topic. For any subject the Extended Essay draws on these two processes; research processes that are subject specific and processes that have greater breadth of applicability.

The assessment of the Extended Essay recognises the value of this distinction through a dual component assessment framework. Each essay is scored according to two sets of assessment criteria; the extent to which an issue is examined in terms of generic aspects (the 'general assessment criteria') and aspects that relate to the domain or subject area of the essay (the 'subject assessment criteria).

This distinction is not unique to the Extended Essay; it provides an appropriate framework for exploring knowledge enhancement generally. The present investigation analyses the influence of students' cognitive styles, motivational orientation and approach to learning on the general assessment and subject assessment scores for the Extended Essay. Examination of the effects on each component score is expected to contribute more fully to implications for effective supervision than focus on a single combined score.

Method

Design : The study uses the score grades of a group of IB students on the Extended Essay to investigate the learning characteristics of each score grade. The approach to learning, motivational orientation and cognitive style data were collected following submission of the Extended Essay and prior to them receiving its grade.

Participants: The essays of 39 Year 12 students who completed the IB Diploma in 2000 and 2001 were analysed. The cohort was 37 % of the Year 12 group for the two years. Students volunteered to be involved and were aware that this involvement would not influence achievement scores in any subject. The essays covered all subject areas. Achievement levels of the students in the various subjects were generally normally distributed and ranged from high to average achievement. Of the cohort, 23 % were had come to the school from another country to study the IB Diploma. The investigator was not a teacher at the school.

Materials and procedures used

Assessment of Extended Essays. Each essay is marked by IB Diploma examiners according to two sets of assessment criteria; general criteria and subject criteria. Eight general assessment criteria are used to assess general aspects such as the clarity of the research question or orientation, the extent to which it is addressed, its interpretation and analysis in terms of relevant data, the extent to which an evaluation or argument of the topic or issue is pursued, a conclusion is synthesised and the presentation displays formal features such as an appropriate abstract. A judgment of qualities such as depth of understanding, creativity and insight is also made.

Each criterion comprises a set of level descriptors, each stating a level of achievement and an accompanying mark. For each criterion an essay is matched with one of these levels and awarded the mark for that achievement level. An essay is awarded a score of up to 24 on the general assessment criteria.

The subject criteria examine the extent to which an essay handles its chosen topic within the context of one of the prescribed subject areas of the IB Diploma. Each subject has a set of criteria. Each criterion comprises a set of achievement levels and each level has an accompanying mark. An essay can earn a

score of up to 12 on the subject assessment criteria. For any essay the two scores are added and the total score is located within one of five bands, each labelled by a letter from A to E. This is the 'overall assessment'.

Each of the essays used in the present investigation has three allocated scores; a general assessment score (GAS), a subject assessment score (SAS) and the overall assessment (a letter grade). The present study investigates the influence of the learning factors on the general assessment score and subject assessment score. The two scores are analysed separately.

To facilitate analysis of trends on Extended Essay scores, each of the two sets of scores was divided into three categories. The rationale for this is as follows. The overall grades for the students involved in the study fell into 3 categories: 36 % of the group was awarded an A grade, 33 % of the group was awarded a B grade and 31 % was awarded a C grade. Based on this distribution, the range of scores for each of the general and subject scores was rank ordered and then divided into three groups, matched as closely as possible on the number of students in each.

Assessment of cognitive style. The verbal-imagery test consisted of two sets of statements. Each statement specified two items. For one set the students needed to decide whether the two items in each pair have the same shape, for example, 'Do the two items had the same general shape ? A marble and an apple ?' This set of statements assessed imagery processing. For the second set they needed to decide whether the two items were the same sort or type of thing, for example, 'Are the two items the same type of thing ? 'A dog and barking ? This set of statements assessed verbal abstract processing. Each set consisted of 30 statements. Students were instructed to work as fast as possible. They had 45 seconds to complete as many as possible. Each student's was the proportion correct out of a total of 1.

The analytic-global test consisted of two sets of pictorial tasks:

(1)   analytic sequential processing was assessed by requiring students to analyse a set of pictorial

         symbols   to decide whether it included two target symbols.

(2)   global processing was assessed using a geometric shapes task in which students decide
         whether two complex shapes are the same.

For each set of tasks, the learner's response accuracy was measured. Each student's score was the proportion correct out of a total of 1. These measures provide a an assessment of the learner's verbal/imagery preference and global/analytic preference.

Assessment of 'approach to learning' This component was assessed using the Learning Process Questionnaire (Biggs, 1987). The scale has 36 items, 12 for each approach, 6 for the motive subscale and 6 for the strategy subscale. Students read each item and ranked it in terms of whether they believed it applied to them on a 5-point scale.

Assessment of motivation orientation A scale consisting of 48 statements that described beliefs and strategies about intrinsic and extrinsic motivation and entitled *What learners believe about learning and themselves as learners* was implemented. Examples of items were 'I know that I can learn topics that are hard to learn' (intrinsic belief), 'My success as a learner depends more on my teachers and how good they are at teaching, rather than on me' (extrinsic belief), 'I learn topics and subjects best by taking them in and memorising them rather than by analysing them' (extrinsic strategy) and 'I chose to study subjects that interested me rather than ones that I need for my career or for further study' (intrinsic strategy). Students read each item and decided the extent to which it applied to them. They ranked each on a 5-point scale.

A belief score and a strategy score for both mastery and performance motivational orientations were calculated for each student. The mean motivation scores of a matched year level sample of 295 average Year 12 students were used as a basis for comparison. The groups were matched on age, number of years of schooling, satisfactory completion of Year 10 academic studies and the range of
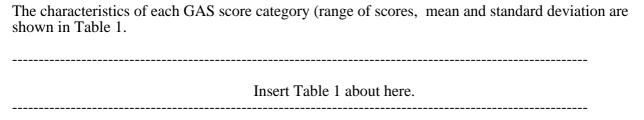
subjects studied. None of the students in either group had learning or emotional difficulties sufficient to influence academic learning. The comparison group had the following mean scores; mastery belief score of 2.36, standard deviation .41, mastery strategy score of 2.31, standard deviation .45, performance belief score of 3.33, standard deviation .50 and performance strategy score of 3.39, standard deviation of .41.

Results

The influence of the learning factors on assessment outcomes.

The distribution of scores for both the general assessment score (GAS) and the subject assessment score (SAS) were divided into three categories 1, 2 and 3. Category 1 contained the highest scores and category 3 the lowest. The influence of each learning factor on each score was examined by comparing the mean scores for the relevant categories. This was done using the 2-tailed t-test for independent samples.   A factor was assumed to influence a difference only when the t-test indicated a certainty level of at least 95 per cent.

Learning factors and the general assessment score

The characteristics of each GAS score category (range of scores, mean and standard deviation are shown in Table 1.

Insert Table 1 about here.

Category 1 had a higher mean score than category 2 and category 3 was lower than category 2. These data support the comparison of the three categories.

The influence of approach to learning on outcome grade Comparison of the mean deep, surface and achieving approach score for each score category showed that students' approach to learning influenced their GAS for both the motive and strategy aspects. Students in categories 1 and 2 had similar deep and achieving motives for learning and used deep and achieving strategies at a similar level. Students in category 3 were more likely to use deep strategies than those in the other categories and less likely to use achieving strategies . They were also more likely to believe that a deep learning approach was an appropriate motive than an achieving approach.

These data show that the use of deep strategies, focusing on learning that is driven by personal interest and high level questioning and analysis of ideas, is insufficient to achieve the highest GAS. The most successful students balanced their use of deep and achieving strategies and motives. This allowed them to align their self directed knowledge enhancement with the assessment criteria.

The trend from categories 1 to 3 also shows an increase in the use of surface strategies. These would not make a major contribution to the creative, analytic or organisational aspects of the essay. They may play a subsidiary role in the information processing and drafting phases. It is possible that students attempted to use surface strategies instead of achieving strategies to align their change in knowledge with the assessment criteria. Assisting them to improve their knowledge and use of achieving strategies may lead to a higher quality essay.

The influence of motivation to learn on outcome grade The mean performance and mastery motivation orientations for each GAS category for beliefs and strategies showed that all categories were more likely than reference group peers to use mastery motivation strategies and beliefs and less likely to use performance motivation strategies and beliefs.

The GAS categories differed in whether one type of motivation orientation dominated. Students in categories 1 and 2 used mastery strategies more than performance strategies while category 3 students

used both types of strategy with approximately equal frequency. The categories also differed in the beliefs they held. While students in categories 1 and 3 valued mastery over performance beliefs, students in category 2 did not differ in their comparative valuing of the two types. The highest scoring category displayed congruence in motivation orientation between strategy and belief, the second group displayed a preference for mastery over performance strategies but not a difference in beliefs, while the category ranked third in achievement valued mastery beliefs over performance beliefs but didn't use mastery learning actions over performance actions.

Trends in motivation orientation indicated that the three categories did not differ either in mean mastery or performance beliefs or in mean strategy use. They did, however, differ in particular motivation strategies and beliefs.

Students in category 3 were less likely than those in category 1 or 2 to reflect on and identify the learning strategies that worked for them or to go back over corrected assignments or tests, see where they made errors and correct them. They were more likely than students in categories 1 and 2 to invest study time working on topics that were unlikely to be on exams or tests. Category 3 students were also more likely, when learning new topics, to ask themselves questions about the topics. When encountering a difficult topic, they were more likely to switch to another topic. These differences between category 3 and the higher scoring categories indicate generally a lower motivation to be 'programmed extrinsically' or to learn in ways that are valued by the culture. They are more motivated to learn and to pursue knowledge that interests them.

Students in categories 1 and 2 differed in areas of performance motivation. Category 2 students were more likely to believe that when they didn't do well in attaining a particular intermediate outcome, it was because they were not up to the necessary standard. This belief may restrict their preparedness to use functional learning strategies; when needing to learn difficult topics or do difficult tasks, they were more likely than category 1 to respond with worry and less likely to implement alternative learning actions.

Both teachers supervising Extended Essays and students need to be aware of the different types of motivation strategies and the influence of each on successful knowledge enhancement. Students can learn the self scripts associated with each type of motivational orientation and the most appropriate contexts for using each.

The influence of cognitive style on outcome grade The three GAS categories differed in each dimension of cognitive style. For the information processing dimension, students who used analytic strategies more efficiently were more likely to be in categories 1 or 2. Higher performance is associated with relative efficiency in both aspects of information processing and with the ability to switch between them as necessary. While global strategies deliver a 'big picture' focus, analytic strategies allow learners to identify detail and to prioritise knowledge in terms of external criteria. While the three categories did not differ in the use of global strategies, category 3 students were least likely to use analytic strategies.

For the information encoding dimension, all GAS categories used both verbal and imagery encoding strategies. While category 1 students processed verbal abstract information more efficiently than imagery information, categories 2 and 3 students used encoding strategies with similar efficiency. The more efficient use of verbal encoding by category 1 students enabled them to encode their knowledge in verbal propositions and to recode imagery knowledge to this form. The Extended Essay requires students to display their knowledge in verbal propositional forms. It is not surprising that students who are stronger in verbal processing achieve a higher grade.

Learning factors and the subject assessment score

The characteristics of each subject assessment score (SAS) (range of scores, mean and standard deviation are shown in Table 2.

Insert Table 2 about here.

Category 1 had a higher mean score than category 2 and category 3 was lower than category 2. These data support the comparison of the three categories.

Approach to learning on outcome grade Approach to learning did not influence SAS. The trend in mean SAS from categories from 1 to 3 suggested an increasing deep motive that did not achieve significance. Trends in achieving and surface motives and in the use of the three strategies were marginal; approach to learning motives or strategies did not discriminate the three categories.

The influence of motivation to learn on outcome grade All categories reported mastery (that is, intrinsic) motivation beliefs more than performance (that is, extrinsic) motivational beliefs. Students in categories 1 and 2 were more likely to use mastery than performance strategies. Students in category 3 used the two types of strategies with similar frequency.

As with the analysis of motivation to achieve at the general level, although the three categories did not differ either in mastery strategies or beliefs or in performance strategies or beliefs, they did differ in particular aspects of each motivation orientation. Students in category 3 were less motivated than those in category 1 or 2 to learn topics and subjects by analysing them and taking them apart rather than by taking them in and were motivated more to memorise them. They were more likely to be motivated to study topics that were unrelated to the prescribed topic and more easily distracted by themes that may seem interesting. They were less motivated than the highest achieving group to review and analyse corrected drafts to see where they had made mistakes and modify what they knew.

At the subject specific level, just as at the general achievement level, category 3 generally showed a lower motivation to be 'programmed extrinsically' than the higher scoring categories or to learn in ways that were valued by the culture. They were more motivated to learn and to pursue knowledge that is interesting intrinsically for them.

Students in category 2 differed from those in category 1 in areas of performance motivation. They were less likely to attribute achieving a poor outcome to their thinking, knowledge or learning ability. Perhaps as a result of this, they were more likely than categories 1 or 3 to worry about needing to learn difficult topics.

Students and their supervisors need to be aware of the different types of motivation strategies and how they affect successful knowledge enhancement in the domain of each subject. As for the general achievement area, students can learn the self scripts associated with each type of motivational orientation and the most appropriate contexts for using each. Supervisors can learn to recognise the particular motivational orientations displayed by students, both at the belief and strategy levels, and help students re-orient these where they are leading to less successful learning. The student-supervisor interaction can provide the context for valuable explicit learning about motivation to succeed in knowledge enhancement.

The influence of cognitive style on outcome grade For the information processing dimension, students who used global strategies more often were more likely to be in category 3. For the information encoding dimension, all grade categories used both verbal and imagery encoding strategies. While categories 1 and 2 students processed verbal abstract information more efficiently than imagery information, category 3 students used both types with similar frequency.

Comparison of the influence of the learning factors on the two scores

The GAS was more sensitive to approach to learning factors than the SAS, although similar general trends were associated with both; the highest scoring students showed a balanced use of deep and achieving strategies, while the lowest scoring category showed higher use of deep strategies. In addition, a higher use of surface strategies was indicated by the trend from highest to lowest scores. One would expect that the analysis of each subject area from a balanced deep-achieving perspective would lead to a better outcome than an increased but less co-ordinated use of deep and surface

strategies. A possible explanation here is that the subject assessment criteria for the various subjects may differ comparatively in the extent to which they demand the use of each approach to learning.

In terms of motivation orientation, a similar trend was noted for both scores. Category 1 students showed higher use of mastery over performance strategies while category 3 students used both types of strategy with similar frequency. Both categories valued mastery over performance beliefs. While category 2 did not differ in their comparative valuing of the two types, they valued mastery beliefs over performance beliefs.

The GAS and SAS showed similar influences for cognitive style. Students who used analytic strategies in a balanced way with global strategies achieved a higher outcomes on both scores than those who used global strategies more often. Similarly, students who processed verbal abstract information more efficiently than imagery information achieved a higher result than those who used both encoding strategies with similar efficiency.

Each category in terms of learner variables

Each category of performance can be described in terms of the learning variables. Category 1 students were more likely to display a higher level of mastery motivation over performance motivation, an approach orientation that balanced deep and achieving strategies and that minimized surface strategies, an information processing style that used both global and analytic strategies and an information encoding style that used both verbal and imagery encoding with verbal encoding dominant.

Category 3 students displayed a higher performance motivation than category 1, an approach orientation that minimized achieving strategies and increased deep and surface strategies, an information processing style that minimized analytic strategies and maximised global strategies and an information encoding style that used both verbal and imagery encoding with verbal encoding dominant.

Category 2 students were between categories 1 and 2 in their use of surface and achieving strategies. They were more like students in category 1 in their use of mastery over performance motivation strategies but not in the congruence of their motivation beliefs and strategies. They were more like students in category 1 in their more efficient use of analytic information processing strategies. In their use of encoding strategies, the category 2 GAS students were more like category 3 students in their balanced use of both verbal and imagery strategies while the category 2 SAS students were more like category 1 students in their more efficient encoding of verbal abstract information.

Discussion

The present study indicates that student achievement in completing the Extended Essay is underpinned by a network of interacting learning and motivational processes. Higher quality outcomes are associated with particular combinations of learning factors used in a self-regulating and self-managing way. Increasing students' awareness of these may be expected to enhance both the quality of their research and their explicit knowledge of how to enhance knowledge.

This interpretation has implications both for the instructional aspects of the Extended Essay and for the explicit knowledge students gain relating to the information-knowledge conversion process. Supervision of the Extended Essay is likely to be optimally effective if supervisors are aware of how these processes influence students' achievement and their implications for practical supervision. Supervision is in many ways strategic coaching. Supervisors are more likely to be successful if they (1) conceptualise students' progress through the Extended Essay as a pathway that involves varying the learning and thinking strategies and the motivation orientation, (2) identify the extent to which individual students use these at any time and (3) modify their teaching to accommodate these changes in learning demands.

Supervisors who can recognise each approach to learning or motivation orientation in their subject area will be more able to provide effective feedback to students and help them manage their learning. A professional development program for supervisors that fosters these areas of understanding is

currently being designed (Munro, 2002). Its purpose is to assist staff to enhance the quality of supervision by developing an understanding of how learning factors influence progress, ways of identifying them and mapping them into teaching / supervision procedures.

The present study is exploratory. It is necessarily limited in the conceptual issue it examines. The number of participants restricted the statistical procedures used. Future investigations might examine the influence of motivational and learning factors on achievement with larger and more varied student cohorts.

A second focus of future research could examine the extent to which the Extended Essay facilitates the learning of improved self management and regulation. The teaching conditions for fostering this knowledge and for monitoring its growth may be investigated. One might expect a link between those who commence the Extended Essay with an enhanced knowledge of self management and self regulation and satisfactory completion.

A third area for future research relates to the display of knowledge gained by students, both during the development of an essay and in the final version. Students differ in the ease with which they do this (Munro, 1999). They also differ in what they know about how to align their knowledge with assessment criteria and how they use feedback from supervisors and others to shape and modify their knowledge. They may also examine how the supervision process can be managed to optimize teaching students to show what they know, to deal functionally with difficult display contexts and to structure their understanding into essays.

A fourth issue relates to differences in cultural influences on the learning factors, given the international and cross-cultural nature of the International Baccalaureate. While studies of cultural influences on learning in this area are limited, comparisons between the learning behaviours of Asian and Western university students in various situations indicate that Asian students are at least as likely to use deep approach strategies as Australian students (Kember & Gow, 1991; Watkins, Reghi & Astilla. 1991) and an intrinsic motivation orientiation (Watkins & Ismail, 1994). Their use of self-regulated learning strategies depends on whether they are learning in their own culture or in a second culture (Purdie & Hattie , 1996; Purdie, Hattie, & Douglas, 1996). Strategy use best predicted academic grade. Belief about the likelihood of success indirectly influenced academic grade through strategy use. Cultural influences had a stronger influence on students' beliefs about whether they were likely to be successful than on their strategy use.

These findings have implications for understanding cultural influences on the completion of the Extended Essay. Future research may examine whether students who study the IB in countries other than their own may have comparative difficulty implementing the self-regulated learning behaviours used by students of that country. They may need to learn, through directed strategy teaching, to modify their set of self-regulatory skills until they are more similar to those of the host country. Supervisors may need to help them to make explicit what they know about aspects of self regulated learning and then to modify this. They may also need to help these students learn positive perceptions of their ability to learn successfully in the host country.

This research has implications for pedagogy beyond the Extended Essay. Its outcomes can enhance teaching and learning in research oriented subjects and tasks. More broadly they add to our knowledge the extent to which formal studies assist students to learn explicitly about knowledge and its enhancement and use and how this can be improved. Strategies for optimizing the effectiveness of teaching programs that assist students to manage and direct their learning most efficiently are identified. At the broadest level they can contribute to the re-conceptualisation of instruction and curriculum that improves students' understanding of knowledge and their ability to research, organise and enhance it.

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Table 1: The characteristics of each general assessment score category.

Characteristic	Score category		
	1 (N = 12)	2 (N = 12)	3 (N = 15)
Range of scores	21- 24	17 - 20	11 - 16
Mean	22.55	18.75	14.72
Standard deviation	1.23	1.03	1.73

Table 2: The characteristics of each subject assessment score category.

Characteristic	Score category		
	1 (N = 12)	2 (N = 15)	3 (N = 12)
Range of scores	11-12	9 - 10	6 - 8
Mean	12.00	9.90	7.00
Standard deviation	.00	.944	1.00