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OVERCOMING COMPUTER ANXIETY THROUGH REFLECTION ON ATTRIBUTION

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Abstract

Computer anxiety continues to be a significant issue for many students. While ever learners experience such anxiety, the use of computers in tertiary education will continue to present significant issues for students and teachers alike. A proliferation of adult education and training initiatives have emerged to assist computer novices to gain the skills needed to operate in the computer domain. However, studies have highlighted that increased exposure can exacerbate rather than 'cure' the problem of computer anxiety, potentially strengthening negative affective reactions and promoting further computer avoidance. One approach to countering computer anxiety is to involve learners themselves in confronting their beliefs, fears and assumptions and help them to develop strategies to overcome their anxieties. A metacognitive approach to computer education provides such an approach. This paper describes one component of a metacognitive approach to computer education, focussing on the incorporation of attribution theory and the impact of enhanced awareness of attribution on computer learners. It is argued that assisting computer learners to engage in both cognitive self-appraisal and cognitive self-management in relation to their attributional characteristics can assist them to overcome computer anxiety and hence make more appropriate use of computers as learning tools.

Keywords

Computer anxiety, attribution, metacognition, pre-service teacher education

Introduction

Computer anxiety has received considerable attention in the psychologically-based literature and is defined as generalised emotional distress or the tendency of an individual to be uneasy, apprehensive and/or phobic towards current or future use of computers (Igbaria & Iivari, 1995). Computer anxiety may include worries about embarrassment, looking foolish or even damaging computer equipment (McInerney, McInerney & Sinclair, 1994). Computer anxiety is state-based; a transitory response to a specific situation. A number of studies (Mahmood & Medewitz, cited by McInerney, McInerney & Sinclair, 1994; Rosen, Sears & Weil, 1993) have found that for computer anxious individuals, increased experience tends to exacerbate rather than 'cure' the problem, with additional computer experiences strengthening negative affective reactions and promoting further computer avoidance. Continuing anxiety after training may be a function of an individuals' prior computing experiences, attitude towards computing, perceptions of self-efficacy and expectations of success (McInerney, McInerney & Sinclair, 1994). In fact, Rosen, Sears and Weil's research challenges traditional skills-based courses, proposing instead a number of approaches to computer anxiety including individualised desensitisation, thought-stopping/covert assertion, information provision (about myths and realities) and support groups.

In this paper a particular focus is placed on the role of an individual's expectations of success and the influences of these expectations on their approach to computer use. The paper will draw from an action research project which focused on developing teaching approaches which foster 'capable' computer users (Phelps, 2001, 2002; Phelps, Ellis & Hase, 2001). It is argued that assisting tertiary students to engage in metacognitive reflection on attributional theory, and its applicability to their attitudes and approaches to computers, can assist them to become more effective learners in computer-based environments.

Attribution Theory

Attribution is, at its simplest, an individual's explanation for their successes or lack of successes. The basic premise of attribution theory is that individuals function as 'naïve psychologists' developing causal explanations for significant events (Martinko, 1995). These beliefs influence expectations which in turn influence behaviour. Attribution theory asserts that people differ in their attributional style and that these differences contribute to motivation, performance and affective reactions to various life experiences. There are three different, but not mutually exclusive, types of attributions:

- those that function to identify the cause of an event;
- those that seek to identify the responsibility for an event; and
- those that refer to personal qualities.

To better explain attribution theory it is important to differentiate between *causal dimensions* and *causal explanations*. *Causal explanations* are the specific explanations people make concerning the causes of prior outcomes. Examples of commonly expressed explanations include luck, ability or effort. Underlying such explanations (attributions) are *causal dimensions* that represent the individual's cognitive structure (Henry, Martinko & Pierce, 1993; Kent & Martinko, 1995a, 1995b; Martinko, 1995). These can be summarised and described as follows:

- *Locus of causality* refers to whether individuals believe the cause resides within themselves (internal) or outside themselves (external). There is a differentiation here between focus of causality and the concept of 'locus of control' as an event can be internal yet uncontrollable (e.g. mood);
- *Stability* (or variability) refers to the degree to which the cause is anticipated to change over time;
- *Controllability* refers to the extent to which a cause is under the control of the individual;
- *Globality* refers to whether the success or failure will occur in all similar situations or only specific sets of circumstances; and
- *Intentionality* differentiates between effort and strategy where insufficient effort may be intentional. This latter dimension is contended in the literature based on arguments that intent and control generally covary and that intent is an action, not a cause, therefore beyond the scope of attribution theory (Kent & Martinko, 1995a).

To demonstrate the interplay between causal dimensions and causal explanations, external explanations might include group interdependence or distractions such as noise, whereas internal explanations might include health or mood. Some explanations are more or less under the control of the person (e.g. effort), some are largely controlled by the context (e.g. task variables), while others may be uncontrollable (e.g. weather or temporary illness).

It is generally posited that it is the causal dimensions rather than the specific attributional explanations that are believed to influence expectancies. 'It is not the individual's belief in a lack of ability per se that is theorized to cause lower expectations, but rather it is the individual's belief that the cause is stable and cannot be changed that results in the lowered expectation' (Kent & Martinko, 1995b, p.26). Attributional theory thus provides a framework for understanding individuals' beliefs and motivations. For instance, individuals who tend to blame themselves for negative events, who think that the cause will occur in different contexts and who think that it will last into the future might be considered as having a 'pessimistic' attributional style. Those who rate the situation in the opposite fashion might be considered as having an 'optimistic' attribution style (Seligman, 1990).

There is a close connection between attribution and social cognitive theory (Bandura, 1977; 1981; 1986; 1992; 1997). The latter is not the focus of this paper, but did form a significant component of the wider research from which this paper is drawn.

Attribution Theory and Computer Usage

One of the earliest connections between attribution theory and computer use appears to have been made by Igbaria (1989) who incorporated attribution as one variable in his research. Few researchers continued this work until a study conducted by Henry, Martinko and Pierce (1993) provided evidence of the potential impact of attributional style on computer-related performance. The relationship between pessimistic attributional style and course grade was not supported, however 'optimistic style' students significantly outperformed less optimistic students. A longitudinal study by Rozell and Gardner (1995) revealed that optimistic users reported more favourable computer attitudes and higher levels of computer efficacy than pessimistic users. Attributional style also accounted for differences in computer related performance. Rozell and Gardner's research led them to conclude that negative computer attitudes and low efficacy expectations and negative affective reactions may cause pessimistic users to view the computer as a 'foe'. An interesting variation on the application of attribution theory to computer learning contexts has been made by Hall and Cooper (1991). These authors focus primarily on causal explanations but more specifically the use of intimate or personal terminology (speaking of the computer as if it was a person) versus objective or instrumental terminology or phrases when referring to computer interactions. Their results indicate that when non-technically oriented students describe successful computer experiences, they are more likely to make mechanical or tool-like attributions to the computer while when reporting a failure experience they attribute more personal characteristics to the computer.

Very little research has been conducted on the potential role of attribution in computer learning and/or training contexts. An exception here is the work of Martocchio (1992), who studied the effects of labelling computer use as an opportunity; opportunity implying a positive situation in which gain is likely and over which one has a fair amount of control. After controlling for pre-training expectations about computer usage, trainees in the 'opportunity' condition exhibited higher computer efficacy and learning, as well as lower computer anxiety, than trainees in the neutral group, suggesting that labelling the context can be a relatively powerful training intervention. Webster and Martocchio (1995) also studied the effects of realistic versus optimistic computer training previews regarding computer software. Realistic previews were those which contained both positive and negative information about the training program. Optimistic previews contained exclusively positive information. This research supported the contention that optimistic previews enhance immediate training experience. However they did not directly relate to trainee satisfaction or learning whereas realistic preview effect on post-training reaction was direct (Webster & Martocchio, 1995).

The abovementioned studies draw from a behaviouralist 'training' model. Very little research seemed to derive from a contemporary adult education perspective. Rozell and Gardner's (1995) research is something of an exception. These authors advocate helping pessimistic users learn about their tendencies to think negatively and enabling them to recognise and change negative thought patterns. Rozell and Gardner recommend a combined approach of both awareness and skill-building as an integral component of computer training programs. Such 'attributional training', Rozell and Gardner argue, could provide 'highly practical and effective tools for empowering and energizing the pessimistic computer user' (p.143). Similar recommendations were made by Henry, Martinko and Pierce (1993) who argued that attributional instruments may be useful in screening and identifying individuals susceptible to frustration and failure. They further state that various techniques could be used to 'immunize and alleviate the unproductive attributions which may lead to failure and learned helplessness' (p.350). These latter two studies seemed to indicate the potential value of investigating whether enhancing students' awareness of attribution, and assisting them to develop strategies to overcome negative thought patterns, might help develop more capable, and less anxious, computer users.

The Research Context

The research from which this paper is drawn has focussed upon the development and delivery of a tertiary computer unit offered as a core to pre-service teacher education students in both the Bachelor of Education (Primary) and Diploma of Education (Secondary) degrees at Southern Cross University, NSW, Australia. The Unit is multi-mode delivered, taking the form of a Web-based resource (also available on

CD-ROM) supplemented with optional face-to-face tutorials. The content deals with a range of topics including the Web, e-mail, mailing lists, synchronous communications, spreadsheets and Web publishing, together with the application of IT in learning and teaching including pedagogical, social, ethical and legal issues. In developing this Unit a particular focus has been placed on developing 'capable', rather than 'competent' computer users (Phelps, 2001; Phelps & Ellis, 2002a, 2002b; Phelps, Ellis & Hase, 2001). The development of teaching approaches which foster computer capability has been the focus of an action research undertaking.

In the second and third cycles of this research a metacognitive approach was introduced to the design and delivery of the Unit. A metacognitive approach is defined as that which assists students to become more aware of their attitudes towards computers (metacognitive knowledge) and their past and current learning approaches with regard to computer skills (metacognitive experience and strategies). A 'Thinking' module was added to the Unit in which theory surrounding aspects of metacognition, and its relevance to computer use, was shared with students. Students were then involved in reflecting on their own cognitive approaches to computers and on their past and present learning processes. The Unit provided a range of prompts for learners to relate prior experiences to new learning tasks through active processes of inquiry and reflection. Students were required to keep a journal which documented their reflections, although the journal task remained quite open and flexible, allowing them to demonstrate their experiences and understandings in multiple and varied ways. Integral to the 'Thinking' module were two self-assessment surveys that assisted students to 'diagnose' and reflect upon their cognitive approaches to computers.

Sources of Data Regarding Students' Attribution

Various survey tools have been developed to determine individuals' attributional style. Some survey instruments 'force' data by classifying subjects' attributions along a predetermined set of causal dimension, thus assuming that the researcher and the participant assign the same meaning to the explanation. The approach which was adopted in this research, however, was based on that of Kent and Martinko (1995a) and Henry and Campbell (1995), asking respondents to assign a cause for the success or failure of the event, then to classify that cause according to dimensions. The instrument presented a number of hypothetical situations involving either success or failure on particular computer tasks and to cite a major cause for each situation then to rank the cause according to the dimensions of causality, globality and stability. The attribution survey thus consisted of six hypothetical scenarios, each representing a situation where, in using computers, they experienced either lack of success or success. Students were asked to provide, as an open response, a reason for that success or failure (attributional explanation) and then to indicate the causal dimension on a seven point likert scale; in other words, whether they felt this reasons was:

- Something to do with themselves or something outside their control (locus of causality);
- Something likely to occur in the future or not (stability); and
- Something that affects them generally or only in this situation (generalisability).

Four questions related to attribution for lack of success; three of which concerned computer contexts and the fourth was general. The situations presented were: receiving a low mark on an assignment for presentation and layout (Question 1), not being able to get a piece of software to work (Question 3), a friend not being able to read an e-mail you send (Question 4) and lastly, things generally going badly (Question 8). Four questions related to attribution for success; three of which concerned computer contexts and the fourth was general. The situations presented were successfully locating information on the Web (Question 2), teaching a successful lesson incorporating computers (Question 5), being able to solve a friend's computer problem with little difficulty (Question 6), and lastly, things generally going well (Question 7).

In accordance with the approaches of Kent and Martinko (1995b) the primary focus of analysis was the attributional explanations, rather than the causal dimensions (locus, stability and generalisability scales). Thus rather than 'force' data into predetermined causal dimensions, Kent and Martinko's approach was utilised, coding attributional explanations into emergent categories. Common themes of attributional explanations were identified and broader categorical headings assigned. This was done for each question without reference to previous questions. Thus each of the causal explanations were grounded in the data itself. Frequency of responses for each of the emergent categories were cross-tabulated with attributional explanations and causal dimensions. Although the responses were provided on a seven-point likert scale

responses were collapsed into three categories for the purpose of analysis, with responses of 1, 2 and 3 collapsed and responses of 5, 6 and 7 collapsed. In this way a clear distinction was made between internal/external, stable/unstable and generalisable/non-generalisable. Responses in the middle (i.e. responses of 4 on the 7-point scale) were excluded from analysis.

Students completed the attribution survey at the beginning of the semester and retained a copy of the survey. As an integral part of the 'Thinking' module of the Unit they were presented with a brief overview of attribution theory and were prompted to reflect (in their journals) on the relevance of attribution theory to themselves, as learners and future teachers. The goals were two-fold: to determine whether attribution theory was a beneficial tool in the metacognitive teaching approach and to triangulate the reflective journal data with that of the attribution surveys. Of a total of 179 students enrolled in the Unit during cycle two, 91 provided permission for use of both their survey and journal as part of the research.

Analysis of the Attributional Data for Lack of Success

Questions 1, 3 and 4 revealed a pattern of internal locus of causality across the participant group; 68% on Question 1, 62% on Question 3 and 42% on Question 4. These responses are roughly consistent with students' general locus of causality for lack of success, being 56% internal. Notably the first two computer-based questions were independent activities, while the third (Question 4) involved another individual receiving the e-mail. Interestingly, a greater proportion of students still attributed this unsuccessful situation to internal factors (42%) as opposed to 36% who attributed this to external factors.

As previously mentioned, it is just as important to analyse the explanations which respondents assigned to the non-successful scenarios. Four attributional explanations were consistently cited, these being lack of knowledge and skills (cited, on average, by 26% of participants); technical problems (24%); incorrect information or instructions (14%); and lack of effort/time commitment (11%), as indicated in Table 1.

Other factors which were cited less frequently and less consistently were 'differing expectations', 'not following directions', 'communication fault of self', 'poor judgement', 'lack of experience' and 'frustration'. From this analysis it can be seen that a student attributing lack of success to lack of knowledge and/or skill is more likely to have internal locus and is somewhat more likely to view this as stable and non-generalisable. A student attributing lack of success to lack of effort or time commitment however was again likely to report internal locus and stable and generalisable attribution. Students attributing lack of success to incorrect information or instructions were equally likely to display internal or external attribution, or be stable or unstable but would be more likely to report non-generalisability. However, in contrast, a student attributing lack of success to technical problems was more likely to report external locus and non-generalisability. No pattern was evident with stability. Thus, students with patterns of external attribution will more frequently cite attributional explanations of either 'technical problems' or 'incorrect information or instructions' to account for lack of success.

				Breakdown as a percentage of the no. of respondents providing that attributional explanation*					
QUESTION 1	Question No.	Freq.	%	Locus		Stability		Generalisability	
				Ext.	Int.	Unstable	Stable	Non-Gener.	General.
Lack of knowledge/skill	Q1	35	35%		86%	29%	26%	46%	29%
	Q3	32	30%		75%	6%	47%	34%	38%
	Q4	14	14%	14%	64%	36%	36%	43%	21%
	AVERAGE		**26%**	5%	75%	24%	36%	41%	29%
Technical problems	Q1	4	4%	75%	25%	50%	25%	75%	
	Q3	26	24%	27%	38%	27%	31%	42%	19%
	Q4	44	43%	48%	30%	18%	39%	68%	7%
	AVERAGE		**24%**	50%	31%	32%	32%	62%	9%
Incorrect information/instructions	Q1	14	14%	21%	36%	43%	21%	36%	14%
	Q3	17	16%	65%	18%	18%	59%	35%	24%
	Q4	12	12%	8%	50%	42%	25%	33%	8%
	AVERAGE		**14%**	31%	35%	34%	35%	35%	15%

Lack of effort/time commitment	Q1	18	18%		89%	39%	39%	33%	56%
	Q3	15	14%		87%	27%	40%	47%	20%
	Q4	1	1%		100%		100%	100%	
	AVERAGE		**11%**		92%	22%	60%	60%	25%

* Note that percentages do not amount to 100% as responses of "4" (i.e. neither internal nor external, stable or unstable, general or non-generalisable) are not shown but are taken into account.

Table 1 Summary of causal explanations relating to commonly cited attributional explanations for lack of success

Analysis of the Attributional Data for Success

Table 2 summarises the data relating to lack of success. All questions again revealed a strong pattern of internal locus of causality across the participant group; 58% on Question 2, 84% on Question 5 and 76% on Question 6. These responses are roughly consistent with students' general locus of causality for success, being 76% internal. Most notably, no students cited external locus of causality in relation to general success. Six attributional explanations were consistently cited in relation to success, these being knowledge/skills/experience (cited, on average, by 45% of participants); effort/time (16%); luck (9%); confidence (4%); education (2%); and ease of task (2%), as indicated in Table 2.

It would be expected that citing a particular factor on one scale (i.e. success) may lead to participants citing a lack of that same factor leading to lack of success. This is the case in terms of 'knowledge and skills' and 'effort/time commitment'. However 'luck' and 'confidence' were more likely to be cited as factors affecting success rather than lack of success. Bad luck, for instance, had not been associated with any of the unsuccessful computer tasks. However, on successful computer tasks the responses had been significant. Twenty students (19%) saw luck as the reason for success on a Web search and 7 students (7%) as the reason for success solving a computer problem. It is only on the successful teaching lesson that luck factors were lower (2%). Luck was, however, mentioned frequently in terms of both general success (12%) and general lack of success (16%). Confidence, again, is cited by students far more in terms of causing success but is not perceived in terms of influencing lack of success. Only 2 students (2%) mentioned lack of confidence as a factor influencing lack of success on an assignment presentation and 4 students (4%) mentioned it in terms of general lack of success.

				Breakdown as a percentage of the no. of respondents providing that attributional explanation*					
QUESTION 1	Question No.	Freq.	%	Locus		Stability		Generalisability	
				Ext.	Int.	Unstable	Stable	Non-Gener.	General.
Knowledge/skills/experience	Q2	45	42%	2%	73%	9%	71%	20%	51%
	Q5	17	16%		88%		76%	6%	76%
	Q6	82	78%		79%	5%	62%	18%	55%
	AVERAGE		45%	1%	80%	11%	70%	15%	61%
Effort/Time	Q2	3	3%	66%	33%	33%		33%	
	Q5	47	43.9%	2%	94%	2%	87%	2%	85%
	Q6	-	-	-	-	-	-	-	-
	AVERAGE		15.6%	23%	42%	12%	29%	12%	28%
Luck	Q2	20	18.5%	33%	35%	25%	45%	55%	35%
	Q5	2	1.9	100%	-	-	-	-	100%
	Q6	7	6.7	29%	57%	29%	29%	43%	14%
	AVERAGE		9.0%	54%	31%	18%	25%	33%	50%
Confidence	Q2	1	0.9%	-	-	100	-	-	-
	Q5	10	9.3%		80%		80%	10%	70%
	Q6	1	1.0%	-	100%	-	100%	-	100%
	AVERAGE		3.7%	-	60%	33%	60%	3%	57%
Education	Q2	2	1.9%	100%	-	-	100%	-	100%
	Q5	0	-	-	-	-	-	-	-
	Q6	3	2.9%	33%	33%	-	66%		33%

	AVERAGE		1.6%	44%	11%	-	55%	-	44%
Ease of task	Q2	1	0.9%	100%	-	-	100%	-	-
	Q5	1	0.9%	-	100%	-	100%	-	100%
	Q6	2	1.9%	-	100%	-	-	100%	-
	AVERAGE		1.9%	33%	66%	-	66%	33%	33%

* Note that percentages do not amount to 100% as responses of '4' (i.e. neither internal nor external, stable or unstable, general or non-generalisable) are not shown but are taken into account.

Table 2 Causal explanations relating to commonly cited attributional explanations for success

It is also interesting that 'hard work and effort', while cited as a strong influence on general success (18%) and lesson teaching success (44%), is not a strong factor on other computer tasks. For instance, with regard the World Wide Web search only 3% of students cited this factor while in relation to solving a computer problem hard work and effort were not cited at all. This was most surprising as both tasks would be expected to require considerable effort.

Reflections on Attribution Theory

Attribution theory proved to be a challenging concept for many students, and was the least understood of the theories focussed upon in cycle 2 (Phelps & Ellis, 2002b). While most did engage thoughtfully with the concept others either misunderstood, omitted or brushed over discussion of this theory. None-the-less the reflective journal data does highlight the important role of attribution in influencing computer users' approaches to computer learning contexts and the influences on their computer anxiety more specifically. Consistent with the survey data, students predominantly reported strongly internal locus of causality. In reflecting on their attributions students tended to identify with one of three different perspectives on the theory.

Perspective One: That internal attribution is intrinsically more appropriate to computer learning contexts. These students perceived a range of advantages associated with internal attribution, including: willingness to tackle new software or problems (Student 39); determination to learn (Student 72); realisation of individual responsibility to pursue knowledge (Student 19); confidence in ability to produce good results in new situations (Student 37); and a tendency to spend more time trying to succeed when having difficulty (Student 153). This first perspective is well depicted by the following quote: 'This is an empowering process as it means I am in charge of my own learning' (Student 4).

Perspective Two: That both internal and external attributional approaches have their disadvantages and advantages. Internal attribution was identified as detrimental, as students tended to blame themselves, rather than consider, for instance, technical problems: 'Whether I succeed or fail I always consider myself to be the causing factor. This occurs even more so when I fail. I rarely stop to think that there might be something wrong with the program I am working on' (Student 65). Students also highlighted the disadvantages of external attribution (for instance Student 27, 39 and 72), primarily the lack of responsibility individuals take for their own learning: 'I've seen some people within the computer labs at University getting really upset and angry because something hasn't worked or they've lost work. Most of them swear and curse at the computer as if it was the computer's fault' (Student 27).

Perspective Three: That successful situations warrant one attribution and non-successful situations warranted a different approach. I came to refer to this approach as 'selective attribution'. This approach was less a rationalised position on the theory than an account of existing personal patterns. Some students, for instance, tended to attribute success externally and failure internally. Others reported the opposite. For some this selectivity was conscious and rational. For others these attributions were revealed to them through the reflection process: 'I blame myself for any failures and tend to not humbly accept praise if I am successful. I will put it down to the computer working well' (Student 113). Student 165 described himself as apprehensive and had avoided using computers throughout his degree. This student came to recognise that he had been making internal attributions when things went wrong and yet external attributions when something was successful: 'my success is due to the help and assistance I have gained from others'. This selective attribution did not just affect inexperienced computer users, although opposite attributional patterns were more likely to be displayed by confident computer users. Student 122

described himself as a ‘computer nerd’: ‘if everything is working on the computer and I am getting the results I want, then I tend to think that it is due to my skill level. However, if something goes wrong, then I blame it on the computer because I feel I know how to work it and I am becoming familiar with the little ‘hiccups’ it often makes’. The selective attribution approach is succinctly summed up by Student 17 who stated that ‘I am arrogant enough to think that everything that goes wrong is outside of my control’.

Beginning to emerge from both the students’ and researchers’ reflections, was a fourth perspective, that which we began to term ‘appropriate attribution’. By ‘appropriate’ we refer to a personal process of actively adopting a cognitive strategy to analyse the situation before making an attributional statement. This approach represents a move away from attribution as a ‘style’ toward using attribution as a cognitive strategy. Many of the less computer confident students were experiencing difficulties in identifying the sources, say, of their computer problems, often attaching internal attributions to problems which were quite probably out of their control. Students who were more confident, however, seemed to posses quite different attributional styles: ‘if I can understand and identify what has gone wrong then the problem is internal… my own fault… If I do not understand what has gone wrong then the problem is external - I could not avoid it’ (Student 164). The reflection of Student 13 might be considered as succinctly representing this fourth alternate perspective: ‘when I encounter difficulties with computers I usually assume that there is a problem with the program, but of course I always check that I've done my part correctly’.

The Impact of Reflecting on Attribution Theory

The inclusion of attribution theory in the Unit’s metacognitive approach was ‘transformational’ for many students. Student 112, for instance, noted that ‘I am very hard on myself, and as a consequence this is damaging to my self-efficacy and confidence’. As she continued: ‘Upon reflection if something has not worked out then I will learn from the situation so that it should not happen again’. Student 8, who attributed both successes and failures to stable internal attributions, initially noted that she did not believe she had the capacity to change her internal causality. Through reflection she acknowledged that ‘I need to be aware to view myself and my ability and even my learning style as something I can change with effort’. For some students, reflection on attribution theory evoked cognitive self-appraisal but this did not translate into self-management strategies: ‘I come to expect failures to occur in situations I am unsure about. I believe that I have little control over these failures and therefore tend to try and avoid them. I don't really see that the situations will change so I prefer to ‘stick to what I know’ (Student 176). However for other students the theory challenged their metacognitive judgements, beliefs and choices. Student 133, for instance, exhibited ‘selective’ attribution, yet the reflective engagement provided an avenue for potential change in learning approach:

> I have just realised that this could have a great effect on my approach to computers. In one way this attitude probably helps maintain my high computer self-efficacy because I attribute good results to my own skills and bad results to something out of my control. But in another way this attitude probably holds me back in my learning... when I encounter a problem I am more likely to give up if I believe that problem is beyond my control.

Even where students’ reflections were less ‘transformational’ these insights into their learning processes may at least have represented a first developmental step. For instance, Student 5 documented her realisation that effort was required to produce change (instability) and that her attitude to the situation, in particular whether it was worth investing time, was most influential on achievement of an outcome. Student 164 realised that she had trouble remembering her computing successes: ‘I find that I just take them for granted and don't see it as success, rather the computer has finally done its job and the right thing’. Student 105’s journal further revealed the potential of reflection in assisting students to challenge their own pre-conceptions:

> As part of my belief system and the law of averages I thought it was realistic to believe that in any situation there is a 50% chance that things will go in any particular way. However in relation to the survey I realise that this is a fairly self-defeating attitude. I can see that my tendency to over generalise gives me a feeling of loss of control in relation to using the computer. I now affirm that I have at least 75-90% chance of causing changes in relation to my computing skills and solving problems because practice gives me more experience to draw on.

Challenging Assumptions about Internal Attribution

Consistent with the literature we perceived internal attribution as positive and assumed that there would be a role for us as educators in assisting individuals to favour internal locus of causality. The process of reflecting on attribution theory significantly challenged our assumptions on both accounts. We realised that many students with low self-efficacy already had internal attribution and that this was increasing their computer anxiety. We also realised that rather than any particular attributional tendency being better than any other, there was value in assisting students to adopt strategies to identify 'appropriate' attribution in each computer context. Student 72, who reported strong internal attribution, provides one such example:

> While I may always have some degree of control over situations it is virtually impossible to always control every situation. I need to both recognise and acknowledge this and accept that sometimes when things don't go exactly as planned there may have been little else that I could have done to change the result'.

Student 179 provided yet another example of the value of reflecting on appropriate attribution: 'I began this course believing… that I held the key to all things happening. However... I have now accepted that there are times when I do not have control over situations; that I am not personally responsible for network down time or someone else adjusting settings'. Reflecting on these comments, we were challenged to consider whether it is possible to assist people to make more accurate and appropriate attributions and this is the focus of subsequent and current research.

Conclusion

This analysis of the interplay between tertiary students' attributions when using computers, represents a significant contribution to the understanding of computer anxiety, and has major implications for the work of tertiary educators in assisting students to gain the appropriate confidence to learn effectively with, and about, computer technology. As ASCILITE members we are comfortable with the use of computers as tools for learning but need to be continually vigilant about our assumptions regarding the comfort levels of our students. Helping our students to understand attribution and the influence of their attributional belief on their computer use can assist them to adopt more appropriate learning strategies. Metacognitive teaching approaches which foster reflective engagement are an important tool in reducing students' computer anxiety.

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