Directing the students' mind games: A game theoretical view of the learning process

Tassos *Patokos,*

Senior Lecturer in Economics, Business School

t.patokos@herts.ac.uk

Abstract

Experimental data consistently shows that the students' beliefs about their own academic ability have a significant effect on their performance and their level of engagement. The aim of this paper is to offer an original game-theoretical model that supports and explains such empirical data: the student is modelled as being engaged in a game, in which his/her decisions on how much to study are affected by his/her self-efficacy beliefs or self-confidence. It is argued that if game theory is used to analyse such games, it is possible to gain insights that might otherwise be missed. One of the implications for practice is that the tutor is in a position to intervene in the interaction involving the student and the student's own beliefs. Attempting to enhance the student's self-confidence levels through feedback is likely to result in greater engagement and better performance, even in cases where the student's current performance does not inspire very encouraging feedback.

Introduction

Most people's first reaction upon hearing the term 'game theory' is that this theory is about how to play games in the literal sense of the word, such as chess or poker. While game theory may be applied to 'proper' games people play for fun, its scope is much wider: A'game' is defined as any kind of interdependence between two or more parties. Interactions between, for example, shop-owners, family members, doctor and patient or two countries can all be seen as 'games', and may be analysed by use of game-theoretic concepts (such as the 'Nash equilibrium'). The theory is commonly associated with economics, because one of its major applications is the study of interdependences occurring in markets (between firms and consumers). Nevertheless, game theory is not contained within economics, but it has infiltrated an array of diverse sciences (such as medicine, engineering,

biology or psychology) that use its methodology for a wide range of purposes. Because of its numerous crossovers with other disciplines, Nobel laureate Roger Myerson has boldly assessed its impact as '*comparable to that of the discovery of the DNA double helix in the biological sciences*' (Myerson, 1999).

Interdependences are abundant in an academic environment, as students interact with other students, tutors and administrative staff on a daily basis. All these interactions may be seen as games, and therefore, they can be modelled and studied with game theory. Examples of such games could be situations when two or more students are engaged in group work, when a tutor designs an assignment in a bid to increase students' engagement, or when a student gets in contact with the tutor to request an extension for his/her assignment – all of them typical scenarios in academic life.

More often than not, researchers in the pedagogic / education literature study games between students or between students and tutors, but do not establish explicit links with game theory. For example, in an attempt to eliminate instances of superficial learning, Azer (2009) explores the interactions between students and tutor in problem-based learning; in a similar but more general venture, van de Pol *et al*. (2010) make reference to 'scaffolding' in the teacher-student relationship. There are also numerous researchers who have written on the pedagogic merits of using games and simulations in the classroom (Annetta et al., 2006; Colby & Colby, 2008, or Lee, 2010), but without extending their analysis to game theory's broader definition of a 'game'. Nonetheless, the literature contains several examples of how game theory may be applied to model interactions in an academic environment: among the most recent contributions, Sadowski *et al*. (2012) coin the term 'game-theoretic pedagogy' and explore how applications of game theory may be beneficial in helping students appreciate their moral obligations to their peers, while, for another example, Zartman (2010) focuses on how game theory can be helpful in enhancing the students' negotiation skills.

This paper proposes a novel way in which game theory may be applied in education. The main idea, explored in the next section, is that, except for the

insights that game theory can offer when used to analyse interactions between students and tutors, it may also be applied to single individuals (i.e. that do not actively interact with others). Section 3 explains how this idea links with the existing literature, and Section 4 discusses the benefits of this theoretical approach and its implications for practice. Section 5 concludes with a general remark and a critical note.

The learning process as a one-person game

Formally, what is needed for a game to be defined is a set of players, the available strategies for each player, and the payoffs for each possible combination of strategies that may be chosen by the players. For example, if Mary and Paul play 'scissors-paper-stone', the set of players is {Mary, Paul} and the set of strategies available to Mary and Paul are {play 'scissors', play 'paper', play 'stone'}. Given that each player has three strategies to choose from, there are nine possible combinations (i.e. different outcomes). Each of the nine combinations is associated with a payoff for Mary and a payoff for Paul (depending on who wins); these payoffs are numbers that may be interpreted as the players' satisfaction levels. For instance, if Mary's satisfaction level from winning is assumed to be equal to one and Paul's satisfaction level from losing is zero, then the combination where Mary chooses 'scissors' and Paul chooses 'paper' will give Mary a payoff π=1 and Paul a payoff π=0. The game is fully defined by the set of players, the set of available strategies, and the payoffs for all possible outcomes. Clearly, for this definition to be meaningful, the set of players needs to have at least two elements. This section proposes an extension of this definition, as it is argued that a game may be defined even when there is only one player.

The main idea will be introduced with another example, which will also serve as a frame of reference for the discussion of this paper: assume that John has to revise for an exam and has a choice between two options (strategies): put high effort (*H*) or put low effort (*L*). Choosing *H* is associated with a good performance, while choosing *L* leads to poor performance. At the same time, John holds a belief about the probability of performing well: this pertains to John's own self-perception

and relates to his self-knowledge, self-esteem or self-concept. If John is quite confident in himself, then his belief that he will perform well will be quite high. On the contrary, if John does not think too highly of his own academic ability, he will attach a low probability to his performing well.

One possible payoff function that could be used for modelling this particular situation would be $\pi(H)=2-q$, $\pi(L)=3-3q$, where $\pi(H)$, $\pi(L)$ are John's payoffs from choosing H and L respectively, and q is the probability with which John believes he will choose H (i.e. q is John's intrapersonal belief about his own action). It is easy to check that if $q<0.5$ (which would mean that John is not very confident in himself) then $\pi(H)<\pi(L)$, which means that John will choose to put low effort (as his payoff will then be greater). Conversely, if $q>0.5$ (indicating a quite self-confident student), then $\pi(H)>\pi(L)$, and therefore John chooses H.

The particular numbers used for John's payoff function could have been otherwise and were only used as an example. What is important here is the key assumption that John's belief (i.e. the probability with which he thinks he will perform well) will have an impact on whether he chooses H or L: if John is confident enough, then he is bound to choose to put high effort, because he would not want to disappoint himself and upset his high self-image. On the other hand, if John is not very confident in his own skills, he might choose to put low effort because he would not want to suffer the discomfort of working hard if this is not very likely to translate to good marks.

Conventional economic theory would view John's dilemma whether to put high or low effort as an individual choice problem (as opposed to a game), because John does not interact with anybody else. Nevertheless, from the moment that John's beliefs about himself affect his choice, a game may still be defined even if there is no one interacting with John in this example. John, as a decision maker, is only affected by his own self-concept. This means that it is possible to view John as made up of two 'partitions' or 'sub-selves': the first partition relates to John's actual behaviour and the decision making process, and the second partition comprises John's intrapersonal beliefs, which affect his decisions. Therefore, it is possible

to define a game, the players being the individual's two 'sub-selves' (Patokos, 2013).

The concept of the multiplicity of the self traces back to at least the 4th century BC, where Plato's *Republic* asserts that the human soul cannot be seen as a homogeneous entity, but rather as having three divisions: 'reason', 'spirit' and 'appetite'. The most renowned view, of course, is that of Sigmund Freud, who developed a structural theory of personality, comprising the 'id', the 'ego' and the 'superego' (Freud, 1960). More contemporary contributions include Rogers (1961), who distinguishes between who an individual really is and who (s)he aims or would like to be, Festinger's theory of cognitive dissonance that studies what happens when the individual's expectations or beliefs are disconfirmed (Festinger, 1957), Bem's self-perception theory (Bem, 1972) or Bandura's theory of self-efficacy (Bandura, 1986), whose relevance to pedagogy will be discussed in the next section.

It is important to note here that the only assumption that needs to be made before John's dilemma can be viewed as a game is a separation between the decision making part of the individual and his/her belief system. This partitioning, however, might as well be conjectured as a manner of speaking – as opposed to holding on a literal level. In other words, the paper does not (necessarily) argue for viewing the individual as a collection of multiple selves; it only asserts that someone's intrapersonal beliefs and actual behaviour are distinct entities, but interacting with each other. This view, while unconventional for mainstream economics and standard game theory, is taken for granted in psychiatry or psychology.

Accepting that intrapersonal beliefs may influence behaviour permits the study of individual choice problems (such as John's) as games. These games, however, are not one-off games, but repeated ones. In the context of John's example, John does not only have to decide between putting high or low effort just once, but in a multitude of instances during his studies. Now, when there are multiple periods, it is apparent that except for beliefs affecting behaviour, behaviour affects beliefs too: if John performed well in previous assessments his self-confidence will be

higher in subsequent instances of the dilemma whether to put high or low effort. By the same token, poor performance in the past is likely to make him think less of his academic worth. Therefore, behaviour and self-perceptions are interweaved: what John believes now affects his current decision of how much to study; but the outcome of his current behaviour will affect what he will believe about himself the next time he has to make a similar decision. Figure 1 provides a visual of this interplay between beliefs and action.

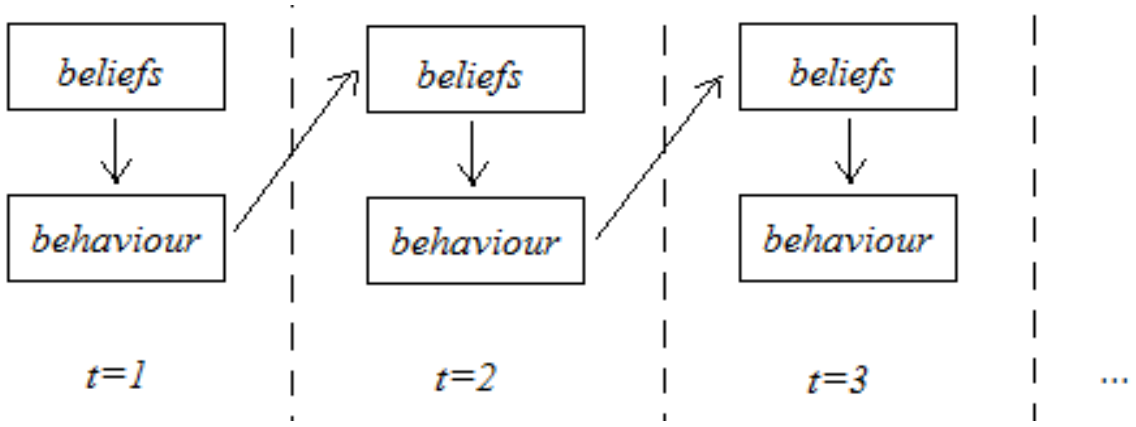

Figure 1: *The intertemporal game between intrapersonal beliefs and action; current beliefs about oneself affect current behaviour, and current behaviour shapes future beliefs.*

If dilemmas of this sort are indeed analysed as repeated games, game theory may offer interesting insights on what the outcome will be and as to how the student's behaviour and beliefs will evolve as time passes. Before some of these insights are presented in Section 4, Section 3 will establish the necessary links of this framework with pedagogic theory, in order to put the discussion in the appropriate context.

elf-efficacy in the education literature and the role of feedback

In psychology the term 'self-efficacy' is used to refer to the beliefs or the expectations that an individual nurtures about whether (s)he will behave in a certain way. According to Bandura's theory of self-efficacy that was briefly mentioned

in the previous section, intrapersonal beliefs may have a significant impact on the individual's actions; in Bandura's own words:

'*People act on their efficacy beliefs in ways that bring about those performances. Those who strongly believe that they can produce desired effects by their actions approach difficult tasks as challenges to be mastered rather than as threats to be avoided*. […] *In contrast, people who doubt their capabilities shy away from difficult tasks, which they view as personal threats. They have low aspirations and weak commitment to the goals they choose to pursue*'.

(Bandura, 1996: p.328)

The concept of self-efficacy and its relevance to student engagement and academic performance is not new to the pedagogic literature. The field of educational psychology has acknowledged its significance, and a multitude of researchers have been testing the validity of the theory with empirical data and experiments: self-efficacy beliefs are consistently shown to be important predictors of academic performance (for example, Gore, 2006; Caprara *et al*., 2008, or Bresó *et al*., 2010), while Fazey and Fazey (2001) show that self-confident students remain motivated even after facing short-term failure. Kaplan et al. (2002) provide experimental data showing that students with lower confidence in their academic abilities tend to prepare less for exams, as they anticipate their own unsuccessful performance. Similarly, Llorens *et al*. (2007) mention a 'positive gain spiral', as they describe how self-efficacy reinforces engagement, and in turn engagement reinforces self-efficacy – which is a full analogy of the repeated game described at the end of the previous section.

Given researchers' consensus on the importance of self-efficacy beliefs on performance and engagement, the implication is straightforward: higher education professionals may enhance academic performance by trying to increase the students' self-confidence (as this would, in turn, promote self-efficacy). This is indeed the first among ten proposals for action that Zepke and Leach (2010) recommend in order to improve student engagement (without, however being specific about how

this could be done). The obvious way with which a tutor may affect the way a student sees himself or herself would be through assessment and feedback. This does not imply that feedback should necessarily be positive: changing the students' self-efficacy beliefs is not about trying to please them, but making them more self-confident. This means that the feedback should convey a clear message that will enhance the student's self-perceptions on his or her academic worth, and regardless of whether the feedback on the work being assessed per se is positive or not.

There is a significant body of research about how feedback impacts on self-efficacy beliefs: Schunk and Swartz (1993) describe experiments showing that learners whose progress is assessed regularly maintain a more positive self-image relative to those who do not receive feedback. Likewise, McColskey and Leary (1985) and Chan and Lam (2007) find that self-referenced feedback (i.e. mapping performance to the student's own skills) is more beneficial than norm-referenced feedback (i.e. comparing performance to that of other students), as the former results in smaller decrease in self-confidence following failure in an assessment. In a review article, Dochy *et al*. (2006) examine and compare a variety of assessment methods as to their impact on self-efficacy and other aspects relating to students' development.

One way with which feedback may be effective in enhancing the students' self-concept is by communicating high expectations. Recognised as a principle of good practice (Chickering and Gamson, 1987) and as a condition under which assessment supports learning (Gibbs and Simpson, 2004; Nicol and Macfarlane-Dick, 2007), the communication of high expectations may have at least two positive implications: firstly, students might try to live up to these expectations in order to not disappoint the tutor. But on another level, the set expectations are likely to operate on the students' self-efficacy beliefs; therefore, the students engage more not only because they do not wish to disappoint the tutor, but also because they do not wish to disappoint themselves (by disconfirming their self-efficacy beliefs). When Chickering and Gamson mention '[e]*xpect more and you will get more*', they make no explicit references to students'

self-confidence, but this principle clearly complements the research that relates assessment and feedback to self-efficacy beliefs.

For a simple example, assume that Mary assesses her own ability regarding a particular course at 55% (which could be interpreted as the mark she expects to receive at the end of the semester). Now, if the tutor conveys the message that (s)he expects Mary to attain at least 70%, this is bound to alter Mary's expectations of her own performance (as, from Mary's point of view, the tutor is in a better position to appreciate how well she can perform). Depending on her trust in the tutor, she will update her self-belief of 55% to a higher percentage (not necessarily 70%). And given that this intrapersonal belief impacts on her behaviour (i.e. her decision on how much effort to put), Mary's performance is now likely to be closer to 70% indeed, for the very reason that the tutor said (s)he expected so.

Communicating high expectations is a recurrent theme in the pedagogic literature: Scott and Tobe (1995) argue in favour of university-wide policies to instigate students' external encouragement, while the view that the tutor's encouraging feedback is one of the factors that determines students' success appears to be unanimously shared across researchers (for example, Schunk, 2001, or Kuh *et al*., 2010). Smith-Maddock and Wheelock (1995) describe the merits of communicating high expectations in a very effective manner by arguing that it helps closing the gap between aspirations (what the students would like to achieve) and expectations (what the students believe they can achieve). This brings in mind the 'dual-self' of the individual and the separation between behaviour and beliefs that was mentioned in the previous section. The benefits of considering this conceptual 'dual-self' model are explored in the next section.

Benefits from using game theory and the link to practice

The game-theoretical framework offered in Section 2 is entirely consistent with the pedagogic literature that claims self-efficacy beliefs may reinforce performance. When the student chooses how much effort to put (for example, for an exam or an assignment), (s)he is affected by his/her beliefs about himself/herself, which in

turn depend on past behaviour. In this sense, the game modelled in Section 2, (the players being the student as a decision-maker and this student's belief system), is a rephrasing of pedagogic research on self-efficacy in game-theoretical language. Nevertheless, use of game theory in this context may offer more than just a supportive theoretical model that fits the experimental evidence on students' self-perception and academic performance.

In fact, if the game is modelled as a repeated game whereby beliefs affect current behaviour and current behaviour affects future beliefs, it is possible to obtain a wealth of interesting theoretical findings: one such result is that overconfident students (i.e. students who overestimate their academic ability) are likely to start performing better and eventually end up confirming their own beliefs even when their performance is initially very weak. This is not common sense, because in a case like this, one might expect that the poor performance in the early stages would affect self-efficacy beliefs negatively, which would then lead to even poorer performance in later periods. Nevertheless, if self-confidence is sufficiently high (and depending on the specific payoffs used to model the game), high engagement and good performance are likely to be achieved even by students who make a very weak beginning to Level 4. The link to practice is then obvious: the tutor needs to be aware that weak performance may improve by an attempt to make the student confident, even when there is not much evidence to justify this confidence. Personalised and encouraging feedback (by communicating high expectations as mentioned in the previous section) can potentially make a big impact by turning under-performers into 'late bloomers'.

Conversely, the game-theoretical framework can show that a competent student with very low self-confidence is likely to experience a performance dip, not due to lack of academic skill. Like the previous case, this is a theoretical possibility that might be missed, because it is counter-intuitive: one would anticipate that good performance in the early periods would translate to a reinforcement of self-efficacy beliefs, which in turn would ensure that performance would remain to a high standard. If, however, the student does not see himself/herself as very skilled (for any reason), then it is probable that these beliefs persist, even after the student

achieves good marks in his/her first assessments. The tutor's presence is once more crucial, as (s)he would need to operate on the student's beliefs by providing the appropriate feedback. In this particular case, the tutor would need to align the student's self-perceptions with reality (as opposed to the previous case where the tutor would want to create some dissonance between what the student achieves and what (s)he believes (s)he is capable of achieving).

The bigger picture appears to be that the tutor should be in a position to 'direct' the students' mind games. This claim might sound dramatic, but if one thinks of the learning process in game-theoretical terms, this is exactly what this is about. Every time the student is about to make a decision that relates to his/her studies, the amount of effort (s)he will put depends to some extent on his/her efficacy beliefs. Some students might perhaps feel comfortable in the role of the underachiever, as this does not raise the bar too high for them. The game then, is in the tutor's hands, because, quite simply, the tutor may change the game by trying to instill self-confidence in students, even if this will have to mean that some students will initially be 'deluded' regarding their current academic ability. The game theoretical framework and the empirical data suggest that this cognitive dissonance might eventually become self-fulfilling, as the higher aspirations are bound to bring about good performance.

Conclusion

One of the aims of this paper has been to give a flavour of how game theory may inform the pedagogic literature. The discussion of the previous section indicates that use of game-theoretical language to model interactions (be it the 'conventional' type, or the intrapersonal games described here) is likely to lead to interesting conclusions that have concrete implications for practice. If game theorists pride themselves that game theory is the theoretical umbrella that unifies the social sciences (Aumann and Hart, 1992), it is somewhat surprising that game theoretical concepts do not appear more frequently in the pedagogic literature. It is already taken for granted that being an expert in one's discipline does not necessarily make one a good educator, as the professional standards involve

several additional dimensions other than expertise (HEA, 2011). If the learning process is viewed through the prism of game theory, the tutor's role is now enriched with a strategic character, as the tutor becomes aware of how (s)he may intervene constructively in the games between students and their own beliefs, in an attempt to enhance the students' personal development.

Finally, a critical note: the claim that overconfidence is bound to lead to greater engagement should not be treated as an axiom, but as a regularity that is confirmed by experimental data, but might not apply to all students. Similarly, the assertion that feedback targeted at enhancing the students' self-confidence will improve performance might not apply to some students (for example, there is the risk that a student becomes too confident and 'rests on his/her laurels' instead of engaging more). Indeed, for some students, there might be an optimal level of self-confidence, which, if exceeded, might have adverse effects on performance as suggested by 'Inverted U' Theory of Arousal developed by Yerkes and Dodson (1908). From the point of view presented in this paper, such limitations indicate that the intrapersonal game described in Section 2 is not always the same across students. The implication for practice is that the educator would need to have some knowledge about the student's personality before (s)he can use feedback that will try to operate on the student's self-efficacy beliefs.

Acknowledgements

I would like to thank Sarah Flynn and Ute Gerhard for their insightful and genuinely constructive comments, as well as Sue Anderson and Simon Baines for their support and helpful suggestions.

References

Annetta, L. A., Murray, M. R., Gull Laird, S., Bohr, S., & Park, J. C. (2006). Serious games: Incorporating video games in the classroom. *Educause Quarterly*, 3, 16-22.

Aumann, R. J., & Hart, S. (eds) (1992). *Handbook of Game Theory with economic applications*. Amsterdam: North-Holland.

Azer, S. A. (2009). Interactions between students and tutor in problem-based learning: the significance of deep learning. *The Kaohsiung Journal of Medical Sciences*, 25(5), 240-249.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*.

Bandura, A. (1996). Ontological and epistemological terrains revisited. *Journal of Behavior Therapy and Experimental Psychiatry*, 27(4), 323-45.

Bem, D. J. (1972). Self-perception theory, in Berkowitz L. (ed.) *Advances in Experimental Social Psychology Vol.6*. New York: Academic Press.

Bresó, E., Schaufeli, W. B., & Salanova, M. (2011). Can a self-efficacy-based intervention decrease burnout, increase engagement, and enhance performance? A quasi-experimental study. *Higher Education*, 61(4), 339-355.

Caprara, G. V., Fida, R., Vecchione, M., Del Bove, G., Vecchio, G. M. Barbaranelli, C., & *Bandura, A. (*2008). Longitudinal Analysis of the role of perceived self-efficacy for self-regulated learning in academic continuance and achievement. *Journal of Educational Psychology,* 100, 525–534.

Chan, J. C. Y., & Lam, S. (2010). Effects of different evaluative feedback on students' self-efficacy in learning. *Instructional Science*, 38(1), 37-58.

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *American Association of Higher Education Bulletin* March 1987: 3-7.

Colby, R. S., & Colby, R. (2008). A pedagogy of play: integrating computer games into the writing classroom. *Computers and Composition*, 25(3), 300-312.

Fazey, D., & Fazey, J. (2001). The potential for autonomy in learning: perceptions of competence, motivation and locus of control in first-year undergraduate students. *Studies in Higher Education*, 26(3), 345-361.

Festinger, L. (1957). *A theory of cognition*. Evanston IL: Row, Peterson.

Freud, S. (1960). *The ego and the id*, trans. J. Riviere, ed. J. Strachey. New York: Norton.

Gibbs, G. & Simpson, C. (2004). Conditions under which assessment supports students learning. *Learning and Teaching in Higher Education*, 1, 3-31.

Gore, P. A. (2006). Academic self-efficacy as a predictor of college outcomes: two incremental validity studies. *Journal of Career Assessment*, 14, 92-115.

Higher Education Academy, The (2011)., 'The UK Professional Standards Framework for teaching and supporting learning in higher education'.

Kaplan, A., Gheen, M., & Midgley, C. (2002). Classroom goal structure and student disruptive behaviour. *British Journal of Educational Psychology*, 72, 191-211.

Kuh, G. D., Kinzie, G., Schuh, J. H., & Whitt, E. J. (2010). *Student success in college: creating conditions that matter*. John Wiley & Sons: United States of America.

Lee, A. (2010). Simulation games: shifting from conceptual learning to experiential learning. *Blended Learning in Practice*, July 2010, 36-49.

Llorens, S., Schaufeli, W., Bakker, A., & Salanova, M. (2007). Does a positive gain spiral of resources, efficacy beliefs and engagement exist?. *Computers in Human Behaviour*, 23, 825-841.

McColskey, W., & Leary, M. R. (1985). Differential effects of norm-referenced and self-referenced feedback on performance expectancies, attributions and motivation. *Contemporary Educational Psychology*, 10(3), 275-284.

Myerson, R. (1999). Nash equilibrium and the history of economic theory. *Journal of Economic Literature*, 37, 1067-1082.

Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: a model and seven principles of good feedback practice. *Studies in Higher Education*, 31(2), 199-218.

Patokos, T. (2013). *Internal Game Theory*. London and New York: Routledge.

Rogers, C. R. (1961). *On becoming a person: a therapist's view of psychotherapy*. Boston: Houghton Mifflin.

Sadowski, J., Seager, T. P., Selinger, E., Spierre, S. G., & Whyte, K. P. (2012). An experiential, game-theoretic pedagogy for sustainability ethics. *Science and Engineering Ethics*, August 2012 [Epub ahead of print].

Schunk, D. H. (2001). Self-efficacy: educational aspects, in Smelser, N. J., & Baltes, P. B. (eds.) *International Encyclopedia of the Social and Behavioral Sciences*. Pergamon, Oxford, 13820-13822.

Schunk, D. H., & Swartz, C. W. (1993). Goals and progress feedback: effects on self-efficacy and writing achievement. *Contemporary Educational Psychology*, 18 (3), 337-354.

Scott, R. A., & Tobe, D. E. (1995). Communicating high expectations: effective undergraduate education. *Liberal Education*, 81(2), 38-43.

Smith-Maddock, R., & Wheelock, A. (1995). Untracking and students' futures: closing the gap between aspirations and expectations. *Phi Delta Kappan*, 77(3), 222-231.

van de Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in teacher-student interaction: a decade of research. *Educational Psychology Review*, 22(3), 271-296.

Yerkes, R. M., & Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurology and Psychology*, 18 (5), 459-482.

Zartman, W. (2010). Negotiation Pedagogy: International Relations. *International Negotiation*, 15(2), 229-246.

Zepke, K., & Leach, L. (2010). Improving student engagement: ten proposals for action. *Active Learning in Higher Education*, 11(3), 167-177