神田外語大学大学院紀要　言語科学研究　第26号（2020）【研究論文】pp. 45-64

Advising, metacognition, and motivation in language learning: A neuroscientific perspective

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Abstract

The purpose of this paper is to explore healthy conditions for language learning to occur from theoretical, practical, and neuroscientific perspectives. The paper begins with an overview of the interrelated fields of metacognition, human motivation, and advising in language learning (ALL). It then presents neuroscientific evidence from the connected fields of self-determination theory, coaching and counselling in order to suggest a research approach that can explore whether ALL stimulates areas of the brain associated with positive affect and emotion self-regulation. The literature still lacks scientific evidence of the effects of ALL on learning, and this paper suggests that neuroscience, combined with qualitative and quantitative psychological methods can address this gap.

Keywords: advising, metacognition, second language acquisition, self-determination theory, neuroscience

1. Introduction

Metacognition plays an important role in the language acquisition process; the ability to deeply understand oneself and how one best learns is particularly crucial. In addition, a healthy psychological state is beneficial for stimulating learning and affects cognition, creativity, and ongoing motivation. One effective way of stimulating metacognitive processes while promoting psychological wellbeing and motivation is through one-to-one dialogue known as 'advising in language learning' (ALL) (Mynard & Carson, 2012).

Due to a recent increased research focus in the field of ALL, we are able to see some of the features of advising and some of the benefits for learners. However, although the body of work on ALL is increasing, there is still a lack of scientific evidence related to actual effects that advising has on learners. The purpose of this paper is twofold. Firstly, it gives an overview of the interrelated fields of metacognition, human motivation, and ALL. Secondly, it presents neuroscientific evidence from the connected fields of coaching and counselling in order to suggest a research approach that can explore whether ALL stimulates areas of the brain associated with positive affect and emotional self-regulation.

2. Theoretical underpinnings of learning

2.1 Metacognition

Broadly speaking, the term *metacognition* is used to describe the learning experiences and cognitive processes that learners engage in (Raphael, 1989). Metacognition incorporates the processing of different kinds of knowledge: declarative knowledge, i.e. the details of the task and its structure and goals; procedural knowledge such as the strategies and approaches needed to complete a task; and conditional knowledge which takes account of conditions and knowing "when and why" to adopt particular strategies and approaches (Raphael, 1989, p. 347). Metacognition is an important aspect of language education and the goal should be to develop metacognitive awareness in learners and not take for granted that they have had previous opportunities to develop this kind of thinking (Kozulin, 1998). Metacognitive awareness incorporates several kinds of awareness such as language awareness, self-awareness, cognitive awareness, social awareness, cultural awareness, and affective awareness (Ellis, 2000). Decades of research indicates that the development of metacognitive awareness is central to success learners have in not only developing content specialisation, but also in the acquisition of a second language (O'Malley, Chamot, Stewner-Manzanares, Kupper, & Russo, 1985; Wenden, 1986). Depending on the field, the terminology may vary, but

there have been some effective ways in which metacognitive awareness has been developed in learners.

2.2 Learner autonomy and sociocultural theory

In the field of second language acquisition (SLA), the term learner autonomy is often the term given to actively developing the kinds of deeper metacognitive processes that are needed in order to succeed in developing a language. Language learner autonomy is broadly defined as the ability to take control of one's learning (Benson, 2011). In practical terms, this means helping students to develop the skills and capacities that they need in order to be effective and self-aware language learners. In addition, it is vital that students also have the opportunities to exercise these capacities in pursuit of their own language learning. This includes developing a metacognitive awareness and control over cognitive, affective, social processes and also oneself. Language learner autonomy is normally situated within sociocultural views of learning (Vygotsky, 1978) where a couple of key concepts are explored: the *zone of proximal development* (ZPD) *and mediation through tools*.

The ZPD is interpreted to be "the distance between the student's level of independent problem solving and the level of his or her problem solving when it is guided or facilitated by the other more competent individual" (Kozulin, 1998, p. 160). The guidance provided by peers and adults in Vygotsky's notion of the ZPD is not unlike the concept of "scaffolding" proposed by Wood, Bruner and Ross (1976). People who help learners to achieve a greater level of mastery of a given area, provide them with a kind of scaffolding until they develop capabilities for themselves (Grabe & Grabe, 1998; Kozulin, 1998). Under this definition, support may be given by an adult or a more experienced peer. More recently, a person who is likely to have a significant role to play in the development of metacognitive awareness and control over language learning is a learning advisor.

Mediation is the process of supporting the development of cognitive and metacognitive knowledge through the use of psychological tools. This process

has the power to fundamentally change aspects of the world or the ways in which individuals see the world. Psychological tools include language, signs, symbols and cultural artefacts that, in some way, serve to facilitate (or mediate) cognitive change. This change stimulates reflection, which in turn affects higher cognitive functions such as voluntary and conscious activities associated with learning, memory, attention, problem solving, and evaluation (Kozulin, 1998; Lantolf, 2000). The role of a learning advisor here is to raise awareness of cognitive changes and, using the tool of language (i.e. intentional dialogue), prompt further reflection and autonomous thinking (Kato & Mynard, 2016; Mynard, 2012). Language is simultaneously used as a psychological tool for the joint construction of knowledge (Wertsch, 2007), but also a "vehicle for the development of cognition" (Mynard, 2012, p. 30). Mynard (2012) discusses the relationship between dialogue, tools and context in an advising dialogue where the three elements overlap. In an updated version of the model (Mynard, forthcoming), Mynard presents a more dynamic representation taking place within different environments from an ecological perspective (Benson, 2017; Steffensen & Kramsch, 2017).

2.3 Affect and learning

One kind of knowledge that is vitally important when learning knowledge relates to affect. Affect is overarching term used to describe preferences, evaluations (Fiske & Taylor, 2013), beliefs, attitudes (Hurd, 2008; Oxford, 2011), emotions, moods, and feelings (Hurd, 2008). Positive affect is normally considered to incorporate emotions which have a positive influence and are associated with feelings of well-being, satisfaction, pleasure, and general happiness. The ability to self-regulate affective / emotional states is helpful for all aspects of life, but I will focus specifically on language learning in this paper. Positive affect is important for language learning for three main reasons. Firstly, language learning requires sustained effort over many years, and the ability to negotiate constant challenge. In order for this to be a realistic goal, positive emotions are needed so that people can persevere and

overcome difficulties (Oxford, 2015). Developing confidence and competence in another language requires a learner to experience success and positive emotions (Bandura, 2008). Secondly, the presence of positive affect has a beneficial influence on cognition (Forgas, 2000) as affect and cognition are largely considered to be bidirectional (Schunk, Pintrich, & Meece, 2008). In other words, we know from psychological and neurological research that the presence of a positive state of mind plays a crucial role in memory and language fluency (Forgas, 2000). Thirdly, affective factors greatly enhance the language learning experience and transform it from what might potentially be the tedious study of lists, grammar rules, and forms, into an experience which can be enjoyable that generates intrinsic interest (Ryan & Deci, 2017).

The relatively new field of positive psychology is "the scientific study of what goes right in life" (Peterson, 2006, p. 4), and allows for the focussed exploration of emotion and language learning and the processes that support people and help them to flourish. Emotions such as well-being, happiness, empathy and confidence are key to successful language learning and help learners to build positive optimism and the resilience needed for a long-term endeavour such as learning a new language (MacIntyre, Gregersen, & Mercer, 2019). Positive psychology interventions are intentional attempts to promote positive affect with the purpose of helping people to thrive. The growing body of research into such interventions in language learning indicate that this will be an influential area for practice in the coming years (Macintyre, et al. 2019). Research taking a Positive Language Education (PLE) approach suggests that well-being can be both an approach and an outcome of education (MacIntyre, et al. 2019).

3. A psychological perspective on human motivation

3.1 Self-determination theory (SDT) and basic psychological needs (BPNs) of autonomy, competence, and relatedness

Self-determination theory (SDT) is a meta-theory of human motivation and wellness (Deci & Ryan, 1987; Ryan & Deci, 2017) that has been applied

to a wide range of life spheres since the 1980s. The theory was originally developed by Deci and Ryan, but has formed the basis of thousands of studies by a large and growing following of scientific researchers. One of the key mini-theories within SDT is basic psychological needs theory (BPNT) which posits—and is backed up by decades of robust psychological research—that three basic psychological needs (BPNs) are required to be present in order for humans to thrive. These basic psychological needs are autonomy, competence and relatedness. Autonomy is the sense of agency and control over one's actions in pursuit of one's life goals. Competence is the sense of optimal challenge and mastery over an area of interest leading to confidence development. Finally, relatedness is a sense of being connected to others and a feeling of belonging and often warmth.

3.2 BPNT and language learning

BPNT underpins an approach to education based on providing autonomy-supportive environments, i.e. those that aim to satisfy the BPNs of autonomy, competence and relatedness. This immediately influences the development of intrinsic motivation, enhances learning performance and also influences wellbeing (Vansteenkiste & Ryan, 2013). When BPNs are not supported, healthy psychological growth is frustrated or thwarted which can lead to behaviours such as passivity, disengagement, or disruptive behaviour which negatively affects optimal functioning and motivation (Vansteenkiste, et al., 2019). Our understanding of how languages are best taught and learned has increased in recent years and there is now a general acceptance that learners who are more aware and in control of their language learning processes are more effective and are able to sustain learning throughout their lives. The aim for language educators therefore is to increase levels of metacognitive awareness and creating learning environments where students' BPN are satisfied in order for people to thrive.

4. Advising in language learning (ALL)

4.1 Research in ALL

ALL is intentionally-structured one-to-one dialogue designed to promote metacognition through deep reflection (Carson & Mynard, 2012; Kato & Mynard, 2016). The advising dialogue draws on sociocultural views of learning (Mynard, 2012), is intentionally structured to support transformational learning where pre-existing and fundamental beliefs about learning are often challenged (Kato & Mynard, 2016). There is a growing body of research in ALL drawing on "linguistic, discursive, pragmatic and social psychological features" (Candlin, 2012, p. 13), but we need to develop a deeper understanding of such processes. Researchers have so far focussed much of the investigations on the nature of the dialogue in order to understand discursive features (e.g. Kelly, 1996; McCarthy, 2010, 2012; Mynard, 2010; Mynard & Thornton, 2012; Pemberton, Toogood, Ho, & Lam, 2001; Rutson-Griffiths & Porter, 2016; Shibata, 2012; Thornton & Mynard, 2012), and more recently the effect that the dialogue has on learning and metacognition (e.g. Mynard, 2010, 2018). This kind of research is normally explored through the use of longitudinal case studies focusing on dimensions of advising such as the role of emotions and feelings (e.g. Tassinari, 2015; Tassinari & Ciekanski, 2013; Yamashita, 2015) and learner identity (e.g. Karlsson, 2015; Karlsson & Kjisik, 2009; Yamamoto, 2017).

4.2 Advising and metacognition

As the concept of reflection is central to the development of metacognition, researchers in the field of advising have drawn upon the work of Dewey (1933) and Schön (1987). According to Dewey, reflection is "active, persistent, and careful consideration" of beliefs or knowledge (Dewey, 1933, p. 118). Drawing on Schön (1987) we can examine the concepts of reflection-in-action (i.e. the here and now) and reflection-on-action (i.e. looking back at what you have done). Applying these concepts to advising practices, skilled learning advisors can assist learners in viewing their learning from different perspectives which

leads to a greater degree of metacognitive awareness. In the case of language learning, this is the awareness of both the language learning process, and the progress that one is making in acquiring the language progress. This implies a focus on the different kinds of awareness that were introduced earlier in the paper (i.e. language awareness, self-awareness, cognitive awareness, social awareness, cultural awareness, and affective awareness (Ellis, 2000)).

4.3 Advising in action

Research has shown a relationship between the dialogue that a skilled advisor uses combined with the nature of the interaction, and the development of metacognition. An effective advisor draws upon a "skilled use of language that extends and enhances the learner's thinking processes and helps him/her to gradually develop his/her way to self-manage learning" (Mozzon-McPherson, 2012, p. 46). For example, a study by Mynard (2018) showed how advising influenced learners' decision-making processes about the ways in which they learned, the resources they chose, and also influenced the depth of reflection they engaged in. The same study showed how a learner who did not receive support in the form of advising did not engage in deeper-level metacognitive thought processes needed for her to be able problem-solve to the same degree as the learners who attended advising sessions.

5. Neuroscientific research in related fields

5.1 A neuroscientific perspective on motivation and BPNs

The majority of the research within the field of SDT so far has been psychological rather than neurological (Reeve & Lee, 2018), but there is much potential. One way in which neuroscience can add a fresh perspective is that changes in the brain can be measured in milliseconds which gives different information that is collected by traditional methods in psychology, normally questionnaires (Reeve & Lee, 2018). Drawing on the two methods can lead to deeper insights about motivational constructs. For example, Reeve and Lee (2018, 2019) have begun work on identifying the neural basis of the

BPNs of autonomy, competence, and relatedness. In one study, Reeve and Lee (2018) used neuroimaging using fMRI to examine whether participants who were exposed to situational conditions that were known to affect their BPNs in order see changes in brain activity. The researchers looked at both *traits* and *states*; a trait is an enduring personality feature, whereas a state is a situationally or environmentally induced phenomena. Currently, psychology research is often concerned with traits, whereas neuroscientific research is concerned with states. However, neuroscientific research into motivational states can eventually lead to an initial understanding of motivational traits with longer studies involving repeat examinations which aim to identify neural correlates. In Reeve and Lee's (2018) study, the neuroimaging results were correlated with self-report trait measures. The results indicated that for motivational traits and states across all three BPNs, stratum-based reward processing, anterior insula–based subjective feelings, and the integration of subjective feelings were associated with intrinsic satisfaction. The researchers concluded that there is coactivation between two areas of the brain (striatum and anterior insula) indicating that there is neurological evidence for the benefits of creating conditions for satisfying three BPNs in terms of motivation.

Some studies have focussed specifically on the BPN of competence in order to identify areas of the brain associated with motivation. In one study (Murayama, Matsumoto, Izuma, & Matsumoto, 2010). Participants performed stop-watch tasks that were perceived to be interesting, and either received positive feedback or monetary reward simulating intrinsic and extrinsic motivation. Results showed activity in the striatum area of the brain triggered by both intrinsic and extrinsic sources of motivation. In another study by Reeve and Lee (2018), the participants completed either an optimally challenging, competence-satisfying anagram task, or (the same participants) worked on easy anagram (i.e. non-competence-satisfying) tasks. The researchers found increased activity in the striatum during the competence-satisfying tasks. In addition, the anterior insular cortex (AIC or anterior insula)

was activated significantly more during the competence-satisfying tasks. The effects of anticipation related to competence-supportive activities have also been studies using EEG methodology. In a study by Meng, Pei, Zheng, and Ma (2016), participants who were exposed to BPNs-satisfying conditions experienced cortical activation when they anticipated positive performance feedback.

Several studies have also looked at neurological activity in experiments related to choice (e.g. Leotti & Delgado, 2011) where autonomy-supportive conditions are present. These studies have shown that the regions of the brain related to rewards such as the striatum and mid brain are activated. In addition, areas associated with self-processing such as the anterior insula are recruited. Leotti and Delgado (2011) conducted a whole-brain exploratory analysis following experiments with choice and non-choice conditions. The researchers discovered activity in the striatum, the AIC, the anterior cingulate cortex (ACC), and amygdala when the participants were given control over personal choices. Replication studies (e.g. Leotti & Delgado, 2014; Murayama et al., 2015) showed similar results indicating that self-determined choice activates regions in the brain associated with reward processing. These neuroscientific studies further validate the psychological research indicating that supporting students BPNs of autonomy and competence is beneficial, but there is less neuroscientific evidence for the BPN of relatedness which would be particularly important in future studies related to advising.

5.2 Neuroscientific research in coaching

Although neuroscience has not yet been applied to the field of ALL, there have been some interesting research findings from the related field of coaching. Institutions such as Case Western Reserve University in the USA have applied fMRI technology to investigate the impact of coaching dialogue on brain activity. For example, Cesaro et al. (2010) and Jack, Boyatzis, Khawaja, Passarelli, and Leckie (2013) observed increased brain activity in the lateral occipital cortex, superior temporal cortex, medial parietal, subgenual

cingulate, nucleus accumbens, and left lateral prefrontal cortex. These are the areas of the brain that indicate visioning and positive affect when taking a particular approach to coaching which places the focus on what the researchers have termed a *positive emotional attractor* (PEO). The PEO is an approach to coaching which engages clients in positive future outcomes. For example, by asking them about their passions and future dreams. The more traditional approach or fields such as academic counselling takes what Jack et al. (2013) term a *negative emotional attractor* (NEA) that is more likely to focus on externally determined criteria such as grades and course outcomes. Themes and questions explored in coaching sessions taking a NEO approach tended to stimulate regions in the brain associated with defence mechanisms and negative affect; i.e. the medial prefrontal regions and right lateral prefrontal cortex.

There is also neuroscientific evidence that the role of dialogue is particularly powerful. Boyzatis (2015) is exploring differences in brain images of participants who write written responses to open PEA-type questions compared with participants engaged in coaching, i.e. one to one dialogue with another person. Although both these scenarios stimulate parts of the brain associated with positive affect and visioning, there is clear evidence to show that the act of engaging in dialogue with others makes the process particularly beneficial.

5.3 Neuroscience research in counselling

The first thing to mention in this section is that neuroscience research in counselling should not be confused with neurocounselling which is where a counsellor helps a client to be aware of how physiology affects mental states and how to self-regulate the physiological in order to benefit the psychological state (Russell-Chapin, 2016). Neuroscience research in counselling on the other hand, is concerned with the phenomenon of neuroplasticity and how psychotherapy or counselling interventions can be shown to directly alter the anatomical patterns and connections within the brain (Kandel, 2000). For

example, cognitive therapy has been shown to reduce depression through increased activation of the prefrontal regions of the brain, in the same way in which antidepressant medication works (Goldapple et al., 2004). Neuroimaging in addition to psychological and other measures have been used to inform psychological methodologies (Goncalves & Perrone-McGovern, 2014). Psychological counselling interventions that have been proven to work, such as cognitive reappraisal (i.e. helping clients to reframe or reinterpret events in order to psychologically cope with them) have been supported by neuroimaging evidence showing responses in the corticolimbic network of the brain associated with affective control (McRae, Ciesielski, & Gross, 2012). Specifically, cognitive reappraisal recruits an increased activation of the ventrolateral prefrontal cortex regions, indicating emotional regulation. Implications for counselling (and indeed, advising), could include various kinds of cognitive reappraisal: such as (a) explicit positive (i.e. considering positive aspects of a negative event), (b) change of future consequences (i.e. realising that the event will be less significant in the future), (c) distancing reappraisal (i.e. stepping away from a negative event), or (d) an accepting reappraisal (i.e. realising that something is inevitable and that nothing can be done). Another potentially valuable area for research relates to environmental enrichment. So far, research seems to only have been done in animals or in early-childhood care but shows strong evidence that areas of the brain associated with sensory and cognitive processes are stimulated when a caring or enriching environment is provided (Goncalves & Perrone-McGovern, 2014).

6. Implications for advising in language learning

The findings from the fields of coaching, counselling and SDT provide evidence of the role of an optimal learning environment that supports BPNs. In addition, we can see from psychological and neuroscientific evidence that one-to-one dialogue within a PEA state, or with the purpose of promoting self-regulation of emotions has beneficial physiological and psychological implications. The next steps surely will be to investigate some of these areas

specifically within the field of ALL.

6.1 Suggested study into ALL

This section will outline a possible study which will begin to understand the benefits of ALL from psychological and neuroscientific perspectives. A sample study could include recruiting four groups of volunteers. Group A represents the optimal conditions for learning. The participants will make and follow a self-directed language learning plan and attend regular advising sessions that are structured according to PEA principles (i.e. satisfying the BPN for autonomy). In addition, the advising will incorporate a focus on emotion self-regulation, and optimal challenge. Group B will make and follow self-directed language learning plans and attend advising sessions that are structured according to principles of NEA (i.e. limiting the satisfaction for the BPN of autonomy). There will be no specific support for self-regulation or optimal challenge. Group C will make and follow a self-directed language learning plan and write reflections on the process. The prompts will be worded according to principles of the PEA, the promotion of emotional self-regulation, and satisfaction of the BPN of competence. Group D is a control group and participants will make and follow a simple self-directed language learning plan, but receive no advising and write no reflections on the process. Approximately ten to 15 participants per group will participate for at least ten weeks which should allow us to observe any changes in the brain, and any differences between participants.

6.2 Research questions

1. Is there any variation in brain patterns over time between participants in the four groups?
2. Is there any variation in language proficiency gain over time between participants in the four groups?
3. Is there any variation in participants' perceptions of the activity over time between participants in the four groups?

In addition to fMRI scans, there will be quantitative and qualitative measures:

1. Pre-, during, and post-intervention questionnaires (with qualitative and quantitative items) will investigate learner perceptions of their learning progress and process.
2. Pre- and post-tests will measure language learning gains (these measures will very according to the participant's goal)
3. Weekly learning journals will document participants' perceptions of the advising sessions and learning process and gain
4. Interviews with participants before, during and after the research process will provide data to help the researchers to understand participants' perceptions of the advising sessions and learning process and gain

6.3 Considerations

The suggested project will need ample resources in order for it to be carried out. For example, the project requires a large research team comprised of language education specialists and neuroscientists. The data needs to be carefully collated and documented in order for potential correlations to be examined. The multiple data collection methods including diaries and fMRI scans are likely to be unusual and possibly intrusive for the participants. Participants will need to be paid adequately, and also trained and monitored carefully so that the research is not compromised. Despite these potential challenges, the research has the potential to be groundbreaking and will provide vital information about how people learn and what support we can provide language learners in order for them to thrive and experience success in learning.

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