



Instructions for authors, subscriptions and further details:

<http://ijep.hipatiapress.com>

The Paradox of the Missing Biological Function in Understanding: Implications for Moral and General Education

Asghar Iran-Nejad ¹

1) The University of Alabama, United States of America

Date of publication: February 24th, 2013

To cite this article: Iran-Nejad, A. (2013). The Paradox of the Missing Biological Function in Understanding: Implications for Moral and General Education. *International Journal of Educational Psychology*, 2(1), 1-18. doi: 10.4471/ijep.2013.16

To link this article: <http://dx.doi.org/10.4471/ijep.2013.16>

PLEASE SCROLL DOWN FOR ARTICLE

The terms and conditions of use are related to the Open Journal System and to Creative Commons Non-Commercial and Non-Derivative License.

The Paradox of the Missing Biological Function in Understanding: Implications for Moral and General Education

Asghar Iran-Nejad
The University of Alabama

Abstract

This essay argues that the endemic moral crisis and the crisis of confidence in education are related; and both are a function, in part, of a paradoxical divide between two types of human understanding: psychological and biofunctional. In the psychological realm, people cause understanding using the psychological theories they know. Biofunctionally, understanding is *caught* by the understander, by analogy to catching a cold, caused by an unknown biological function, without the understander (a) having direct access to the cause, (b) knowing what the cause is, and (c) realizing how the cause works. This paradox introduces a divide between people's psychological and biofunctional types of understanding. Unwarily, people tend to overlook this divide thereby compromising their full understanding potential. In this essay, I elaborate on the nature of this paradox, the awesome divide that it causes, and its implications for moral and general education.

Keywords: moral education, crisis of confidence, biofunctional understanding, evolution, cognition as computation

La Paradoja de la Función Biológica Perdida en la Comprensión: Implicaciones para la Educación General y Moral

Asghar Iran-Nejad
The University of Alabama

Resumen

Este ensayo sostiene que la crisis moral endémica y la crisis de confianza en la educación están relacionadas; y las dos existen en función, en parte, de división paradójica entre dos tipos de entendimiento humano: el psicológico y el biofuncional. En el ámbito psicológico, las personas causan el entendimiento usando las teorías psicológicas que conocen. Biofuncionalmente, el entendimiento es *pillado* por quien entiende, como quien -por analogía- pilla un resfriado, causado por una función biológica desconocida, sin que quien entiende: a) tenga acceso directo a la causa; b) conozca cuál es la causa; c) se de cuenta de cómo funciona esta causa. Esta paradoja introduce una división entre los tipos de comprensión de las personas, el psicológico o el biofuncional. Imprudentemente, las personas tienden a pasar por alto esta división comprometiendo su potencial de comprensión completo. En este artículo, desarrollo la naturaleza de esta paradoja, la formidable división que causa, y sus implicaciones para la educación general y moral.

Palabras clave: educación moral, crisis de confianza, comprensión biofuncional, evolución, cognición como computación

Media reports and scientific publications on the failures of human morality appear at an alarming rate (Anderson, 2012; Haque & Waytz, 2012; Smith, 2012). To cite a media example, in his letter of resignation from Goldman Sachs published in Times Op-Ed (Smith, 2012) on March 14, Greg Smith stated that it “makes me ill how callously people talk about ripping their clients off.” These publications are only a passing reminder of the widespread occurrences of moral disengagement, inhumane conduct, and dehumanization (Bandura, 1999, 2002; Pekarsky, 1982). Nevertheless, the fact that departures from moral conduct are reasonably suspected or claimed to happen so readily in people is astonishing.

Bebeau, Rest, & Narvaez (1999) commented on an ongoing concern that “American society is in a state of crisis, moral decay, or serious decline” (p. 18). The investigators further put out a call saying “if different approaches addressed different dimensions of development, if viewed as complementary rather than contradictory, we may be able to move beyond ideological and philosophical disputes to solid theory-building based on empirical findings” (p. 18). More than a decade has passed and morality is still on the list of endangered intellectual capacities (Carter, 2005). Close to two decades before that, Schön (1983) had placed education on the list; and I have not seen yet any shining indicators that it has been taken off the list.

Assuming that both moral and general education are falling short of the expectation for their missions, I begin in this essay with the why question and continue to investigate what kind of moral and general education are likely to change things for the better. I believe a robust foundation of theory and research already exists for addressing these questions. Interdisciplinary progress is converging from the related fields of evolutionary biology (Baumard, André, & Sperber, 2013; Iran-Nejad & Bordbar, 2013), moral development (Rest, Narvaez, Thoma, & Bebeau, 2000), social learning (Bandura, 1991; Bandura, Barbaranelli, Caprara, & Pastorelli, 1996), and neuroscience (Greene & Haidt, 2002; Haidt, 2003) beckoning educational researchers to move beyond ideology and toward convergent integration (Bebeau et al., 1999).

Context, Purpose, and Definitions

The central thesis of this essay is that today's moral crisis and the crisis of confidence in general education are causally related and due, in part, to an awesome gap between psychological and biofunctional understanding (Iran-Nejad & Ortony, 1984). For a clearer focus, it is useful to microscope the distinction. Biofunctional is the kind of understanding that is caught spontaneously, rather than caused deliberately, by the understander (Iran-Nejad, 2012; Iran-Nejad & Gregg, 2001). It is regulated effortlessly by some evolution-sculpted combination of multiple internal and external sources working together simultaneously (Iran-Nejad & Chissom, 1992). The biological person may be able to advance the causes of this kind of understanding more readily by developing sensitivity to its overt symptoms (e.g., aha clicks, hindsight solutions to past problems, or the excitement or interest that comes with them) than familiarity with covert causes (e.g., how the mind recalls past ready-made events, how biology sounds understanding clicks, or what produces spontaneous excitement or interest). By contrast, psychological understanding is something the understander causes deliberately using the psychological or mind theories provided spontaneously by biofunctional understanding. Moral and educational problem solving can benefit substantially from the complementary ways biofunctional and psychological kinds of understanding work together (Iran-Nejad, 2000; Prawat, 2000).

To set the groundwork for where this article is going, I begin with what is frequently practiced in science, namely, using analogy. Already overused are the spatial memory metaphors (Roediger, 1980), technological metaphors such as the bottleneck (Broadbent, 1958), the telephone switchboard (John, 1972), and the computer (Neisser, 1967). To be sure, these metaphors have shed much light on people's cognitive capabilities; but their continued use can only thwart the progress. Instead, I turn for new metaphors to biological systems that are also used from time to time and are becoming more acceptable (Mandler, 2007; Miller, 1978). In particular, there is compelling evidence to propose that, by evolutionary design, understanding is the special *biological* function of the nervous system (Drack, Apfalter, & Pouvreau, 2007; Iran-Nejad & Ortony, 1984; Weiss, 1949) just as breathing is a

special function of the respiratory system and fighting germs is a special function of the immune system (Gomez, 1996; Iran-Nejad & Gregg, 2011). Then, with biofunctional understanding already in place as the prerequisite, people may use its overt symptoms (e.g., revelation clicks) to cause their own psychological understanding deliberately using such psychological tools as theories of how the human mind or biology might work, learn, or understand. This is analogous to the fact that people can do things deliberately to an effortlessly functioning respiratory system, namely, holding one's breath, taking deep breaths, coughing, smoking, and the like.

The Paradox of the Missing Biological Function

The sharp distinction between biofunctional and psychological kinds of understanding uncovers an intriguing paradox. There are several reasons behind the paradox and its direct tie with biofunctional understanding. First, the biology of the nervous system controls secretly the causes of understanding. Some of the covert sources are distal but, nevertheless, inescapable. They may be hours, days, months, or even years removed from the proximal symptoms that they remotely produce in the form of what people experience after the fact as understanding. In addition, the biology of the nervous system leaves the psychological person of the understander completely in the dark about how it performs the special function of biological understanding. As a result, given the concept of biofunctional understanding and its remote ways and means, understanders have no psychological idea whatsoever about how that kind of understanding happens to them, just as someone may catch a cold or another illness without knowing anything at all about its distant causes and ways until psychologically detectable symptoms (e.g., the fever) reveal themselves.

Second, and here is where the paradox begins, people know that they understand because they experience the symptoms of understanding psychologically; e.g., they might detect after the fact their own clicks of understanding (Auble, Franks, & Soraci, 1979; Iran-Nejad & Stewart, 2011). This is analogous to feeling the fever long after the person has caught the virus.

Third, and here is the crux of the paradox, understanders are faced with the impossible challenge of making biofunctional understanding to happen without knowing how. As a result they must come up with some sort of a psychological theory (e.g., "To understand, I must connect ideas together") without knowing at all if the theory does indeed cause understanding. This means that there is an awesome divide between biofunctional and psychological understanding that acts like a mind-to-brain barrier impossible for psychological understanding to cross directly.

Finally, and we are still caught in the grips of the awesome paradox, even if an understander happens to hit upon a theory that actually triggers biofunctional understanding directly, it is going to be impossible to tell because the resulting psychologically-caused understanding joins surreptitiously the silence of biofunctional understanding just as it occurs. The good news is that biofunctional understanding continues, even in the absence of psychological understanding just as breathing occurs in the absence of taking deep breaths or smoking and healing occurs even in the absence of nursing—sometimes. An even better piece of news is that biofunctional understanding does not have to wait on being triggered by psychological theories just as healing does not have to wait for nursing to begin. In fact, in the absence of psychological theories, the very young children do and develop most of their biofunctional understanding before they come up with their very first theories, learn how to use the new theories, and start reaping the benefits of the psychological symptoms of their biofunctional understanding or be led or misled by their own mind theories. As far as the contribution of their psychological understanding is concerned, many understanders would be confined unwarily to the realm of their mind theories. The immediate implication for schooling for moral and general education is to focus on enriching the pretheoretical sources of biofunctional understanding by virtue of its overt symptoms, while scientists are learning to close the gap between psychological understanding and biofunctional understanding (Donoghue, Nurmikko, Black, & Hochberg, 2007). This is never an easy task even for scientists given the large diversity of psychological theories not all of which are a good fit for causing biofunctional understanding.

Cognition in Silent Biofunctional Understanding

The results of a study by Iran-Nejad and Chissom (1992) offer a partial glimpse at cognition in silent biofunctional understanding. At one extreme, many psychological theories that learners invent and use may cause no biofunctional understanding at all; they may be as ineffective as inert knowledge (Bereiter & Scardamalia, 1985; Renkl, Mandl, & Gruber, 1996). At a less extreme level, somewhere in between, many theories may cause biofunctional understanding; but as silently as if no biofunctional understanding is happening at all. Consider the statement (1) *I make a list of possible exam questions and learn the answers to them*. To those who use it, this statement promises to cause understanding in an academic setting. Is the theory exemplified by this statement more effective in causing biofunctional understanding than the effectiveness of a placebo pill on a growing infection? The answer to this question may point to significant contributions to learner self-efficacy, learned helplessness, or the like. At the other extreme, biofunctional understanding may be the very cause of the ubiquitous clicks of understanding. Compare Statement (1) with Statement (2) *Discovering new ideas causes excitement in me*. Excitement may be a symptom of biofunctional understanding. To many such outcomes of their biofunctional understanding (i.e., the new ideas and the excitement that comes with them) may shine as strikingly as the sunshine itself (Bransford & Schwartz, 1999). Learners might say they had a light bulb go on in their head; and, again, the frequency by which this occurs to a learner may be a significant contributor to that learner's self-efficacy or learned helplessness. For example, one set of predictions might be that the theory in Statement (1), if deliberately applied, may promise but cause no understanding and the outcomes implied by Statement (2) may be true symptoms of self-efficacy; even though they may emerge effortlessly and spontaneously, from remote sources of understanding, in the form of new ideas and excitement in the silence, so to speak, of biofunctional understanding.

In the Iran-Nejad and Chissom study, 99 undergraduates rated statements like the above with regards to how frequently they experienced them in their studies. The results surprised the authors. Both psychological understanding and biofunctional understanding

correlated significantly with cumulative grade point average (GPA), $r_s=.22$ and $.42$, respectively. However, the correlation between psychological understanding and GPA decreased to a nonsignificant level (partial $r=.13$), when the contribution of biofunctional understanding scores was removed. By contrast, when the analysis removed the contribution of psychological understanding, the correlation between biofunctional understanding scores and GPA remained virtually unchanged (partial $r=.39$). Given that people spend so much of their time in an academic setting with their psychological theories, and so little of it with their biofunctional understanding; it is surprising how little the former, and how much the latter, did for the participants of this study. The former literally had no better than a placebo effect and the latter accounted for all the variability.

It is critical to recognize that the theories that are psychologically well understood may be rigorous but not necessarily relevant in the sense described by Schön (1987). Given the paradox of the missing biological function, relevance is a function of the full cycle of psychological-biofunctional understanding. This does not reduce the value of either psychological or biofunctional understanding as distinct ideologies. It means that the psychological and the biofunctional complement each other in their contributions to human understanding. A straightforward and useful way to think about psychological understanding is in terms of its level of noisiness, so to speak, compared to the completely silent biofunctional understanding. Clearly, noisiness of the psychological theories of the participants in the Iran-Nejad and Chissom (1992) study did not always help them toward their academic achievement measured by GPA, unless these theories were immediate outcomes of biofunctional understanding (e.g., discovering new ideas in an insight). A significant part of the problem is that many students go by the noise of psychological understanding and have no way of actively embracing the challenge of the silent biofunctional understanding. Unfortunately, because of the hitherto unsuspected nature of the biofunctional understanding, education has unwarily overlooked it and focused exclusively on psychological understanding.

By the same token many investigators assume that the apparent effortless of the symptoms associated with biofunctional understanding is the trademark of automatic mind habits. In reality, the

seemingly effortless work of biofunctional understanding is neither effortless nor automatic at all. Rather, it is very hard work of the missing function that only seems to be effortless because it happens behind the stage in the silence of biofunctional understanding, a silence that is suddenly broken into the loud click of understanding of some strikingly new idea along with considerable excitement as well as the loudly exclaimed aha outburst (Auble et al., 1979).

These considerations suggest that moral and general educators might begin by cleaning the house of psychological understanding. There is an awesome divide between the covert work of biofunctional understanding and the overt occurrence of psychological understanding that favors the latter unfairly. The division begins with people's potentially-fallacious psychological theories misleading them into expecting cause-effect access to the full range of genuine human understanding; while, in actuality, the theories may be delivering nothing of the sort, as the results of the Iran-Nejad and Chissom (1992) study might suggest. Moral and general education cannot afford to disregard this possibility. This divide is awesome because, for unwary understanders, it could amount to a fruitless journey lasting a lifetime, not to mention holding back the field of education as a whole.

The journey across the silent stretch of biofunctional understanding with no contribution from psychological understanding is not very different from the state of the art in contemporary education. What may be seen a lot even today in the post-revolution cognitive psychology is cognition as structural computation inspired by the hardware-software division of the computer metaphor. Students, who end up believing in this type of biofunctionally-unrelated cognition, are highly prone to construct their theories on the basis of the spatial metaphors of the prevalent storage-retrieval architecture of the information processing theory (Mayer, 1996; Roediger, 1980). Teachers who believe in these metaphors build their theories of teaching based on them; and researchers who believe in them, base their scientific theories on them (Rosenshine, Meister, & Chapman, 1996; Sweller, Van Merriënboer, & Paas, 1998). It is not difficult to imagine an epidemic of memory theories that run counter to the mission of education for understanding (Bloom, 1984). What is needed is more research along the lines reported

by Iran-Nejad and Chissom (1992) for sorting out the effectiveness of psychological theories in causing biofunctional understanding.

The Biofunctional-Psychological Divide in the Pretheoretical-Theoretical Guise

The biofunctional-psychological divide described so far may have been among us for centuries in philosophy in the guise of a distinction often reported between people's pretheoretical intuitions and their official theories (see, e.g., Nahmias, Morris, Nadelhoffer, & Turner, 2005). Some psychological theories such as helping the needy are more biofunctionally transparent to people's pretheoretical intuitions. For example, no great distance is apparent between people's pretheoretical intuitions about empathy or compassion and the theory that helping the needy is an intrinsically moral characteristic (Baumard et al., 2013). Having observed someone to help a person in need, most people are able to appreciate that empathy and compassion may be behind the deed. The fact that appreciation, a near synonym of understanding, closes the gap between pretheoretical intuition and moral theory supports the assumption that moral intuition is a special kind of understanding.

By contrast, there is more of a divide between people's pretheoretical moral intuitions and their theories behind, for example, paying or evading taxes (Greene & Haidt, 2002). This is probably why paying taxes is taken for granted rather than appreciated; and tax evasion is punished rather than treated by cultivating appreciation for it. The pattern seems to be the opposite for empathy and compassion. People appreciate empathy more than taking it for granted; and promote empathy more than punishing for it. Another way of looking at the awesome divide is that paying and evading taxes assume psychological deliberation; whereas empathy and compassion assume nondeliberate motivation. Why is it harder for people to appreciate paying taxes and easier to punish tax evasion? Why is it easier for people to appreciate empathy and harder to punish for evasion of empathy or compassion? As Greene and Haidt (2002) have suggested, these questions may be addressed using the differences between evolution-ripe biofunctional

understanding and relatively evolution-green psychological understanding. Similarly, to use Schön's (1987) language, psychological theories behind tax payment and evasion are more rigorous--e.g., in legal terms—than relevant to the person of the individual in the swampy trenches of real life. By contrast, the theories behind empathy and compassion are more relevant than rigorous. Schön seems to recommend a more direct focus in education on people's pretheoretical intuitions. Unfortunately, nearly three decades after Schön, people's pretheoretical intuitions are not a more well-known target for nurturing in today's academic settings.

A similarly awesome divide is often found between scientific theories and the pretheoretical intuitions of study participants. Consider the trolley dilemmas, well-known as a challenge to moral researchers and philosophers (Greene & Haidt, 2002). Imagine a scenario where a stampeding trolley is about to kill five people caught inescapably on its tracks. The only hope for them is to hit a re-route switch to send the trolley to a set of side tracks, killing only one unfortunate soul on its way. Most participants ok hitting the switch to save the five and kill the one. This is a rigorous decision based on easy but perhaps less relevant math, by Schön's (1987) definition, involving the cognition-as-computation formula ($5-1=4$). Unfortunately, as Schön (1987) has capably demonstrated, the stone-solid rigor of the math on the safe hill of computational research is irrelevant to the dangers lurking in the swampy trenches of the real world. In the language of this essay, the psychological theory of $5-1=4$ is inert; it is too lean in biofunctional-understanding potential. To appreciate how ingenious Schön's observation has been, imagine a similar scenario where no side tracks exist; but a fat person happens to be standing by who, if toppled would die but also stop the trolley and save the five. The pretheoretical intuitions of most participants say no to this one. As Schön would explain, cognition as computation theories can explain the results of the first scenario based on rigorous mathematics; but are left in a quandary with the swampy trench of the second scenario.

The Two Sides of the Coin of Moral Understanding

As already suggested, a growing body of research indicates that there are two sides to the coin of moral understanding. First, from a theoretical standpoint, the obverse side of this coin is moral engagement and the converse is moral disengagement (Bandura, 1990; Zengaro, 2010). From the biofunctional standpoint, the obverse is a cohering (or constructive), healing, and humanizing process and the converse is an incohering (or unconstructive), hurting, and dehumanizing process. There is evidence that this cohering/incohering process interacts intimately with moral performance dispositions (Zengaro, 2010). A cohering performance disposition encompasses moral engagement, positive affect, and less negative emotion. In a game of sports, for example, a winning combination for a team may engage this performance disposition in its players and their fans. An incohering performance disposition involves moral disengagement, negative affect, and less positive emotion. In a game of sports, a losing combination for a team may engage this moral performance disposition in its players and their fans. In a structural equation modeling study, Zengaro, employed a theoretical structural equation model that contained multiple variables as indicators of cohering (e.g., interest, positive affect, moral cognition) and incohering (i.e., moral disengagement, negative affect, and general aggression) performance dispositions. Zengaro found that a cohering performance disposition was not but an incohering performance disposition was a significant predictor of the acceptance of sports aggression in Italian adolescents.

In the process of biofunctional understanding, cohering (or constructive) mutualistic morality may be spontaneously rewarding as well as humanizing in the direction of camaraderie and more moral engagement (Baumard, André, & Sperber, 2013). By the same token, incohering (or unconstructive) biofunctional understanding might be spontaneously punishing as well as dehumanizing in the direction of shame and moral disengagement. In a school setting, obvious cohering examples are empathy, altruism, passion and compassion. Incohering examples are selfishness, greediness, aggression and bullying. Whereas the choices for moral education in schooling should be clear, there is growing evidence that the academe actually works in favor of the

dehumanizing suppression of humanizing emotions such as passion and compassion (Neumann, 2006), rather than going for the process of humanizing education. The awesome gap that currently exists between people's pretheoretical biofunctional understanding and the formal or official educational theories that drive the academe business may be in part responsible.

Conclusion

The paradox of the missing biological function and the resulting divide between psychological theories and the biofunctional nature of people's understanding may be impacting the moral and general wellbeing of the science and practice of education. A tough immediate challenge is that we live more than ever in an era of confusion surrounding human and nonhuman intelligence. To survive this state of confusion, educational science must be more systematic and unambiguous about the fact that it is in the business of educating people and their biofunctional understanding. As Blasi's (1980) review of the literature pointed out decades ago, it is not surprising that "the present state of research and theory about moral functioning is the mixture of opposite terminologies and metaphors" (p. 4), adding in a footnote that (a) there is "ambiguity in the terms *cognition* and *cognitive*, which has become more apparent with their increased popularity" and (b) when "these labels are applied to theories as diverse as Piaget's and W. Mischel's (1973), the result is utter confusion" (p. 3).

There are definite signs that not everything is well with the way educational science is serving the citizens. Moral disengagement (Bandura, 2002), dehumanization (Haque & Waytz, 2012; Pekarsky, 1982), and inhumane conduct (Bandura, 1990) are widespread. Other educational woes include the pathologies of learning (Shulman, 1999), the problem of transfer (Bransford & Schwartz, 1999), and the puzzle of inert knowledge (Bereiter & Scardamalia, 1985). A hitherto unsuspected paradox in the way biofunctional understanding runs its natural course may be a significant contributor to these problems and the solutions.

The paradox introduces an awesome divide between the psychological theories people use in diverse settings and their

biofunctional understanding (or pretheoretical intuitions). The problem is exacerbated by the nonhuman metaphors, spatial or technical, that make up the substance of today's psychological theories. Therefore, I have taken the step, long overdue, to turn to biofunctional metaphors for clarifying the nature of human understanding. A straightforward implication based on the metaphoric evidence from how other bodily systems function is that understanding is the special function of the nervous system. This assumption has led to the discovery of the paradox of the missing biological function and to the exploration of how people's biofunctional understanding is the mirror for reflecting their pretheoretical intuitions. Educational science and practice, then, can rely on these pretheoretical intuitions as a compass for using psychological theories in the service of causing further biofunctional understanding.

References

- Anderson, J. (2012, March 27). SAT and ACT to Tighten Rules After Cheating Scandal, *The New York Times*. Retrieved from http://www.nytimes.com/2012/03/28/education/after-cheating-scandal-sat-and-act-will-tighten-security.html?nl=todaysheadlines&emc=tha2_20120328
- Auble, P. M., Franks, J. J., & Soraci, S. A. (1979). Effort toward comprehension: Elaboration or "aha". *Memory and Cognition*, 7(6), 426-434. doi:10.3758/BF03198259
- Bandura, A. (1990). Selective activation and disengagement of moral control. *Journal of Social Issues*, 46(1), 27-46. doi:10.1111/j.1540-4560.1990.tb00270.x
- Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational behavior and human decision processes*, 50(2), 248-287. doi:10.1016/0749-5978(91)90022-L
- Bandura, A. (1999). Moral disengagement in the perpetration of inhumanities. *Personality and social psychology review*, 3(3), 193-209. doi:10.1207/s15327957pspr0303_3
- Bandura, A. (2002). Selective moral disengagement in the exercise of moral agency. *Journal of Moral Education*, 31(2), 101-119. doi:10.1080/0305724022014322

- Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (1996). Mechanisms of moral disengagement in the exercise of moral agency. *Journal of Personality and Social Psychology*, 71(2), 364-374. doi:10.1037//0022-3514.71.2.364
- Baumard, N., André, J. B., & Sperber, D. (2013). A mutualistic approach to morality. *Behavioral and Brain Sciences*, 36(1), in press.
- Bebeau, M. J., Rest, J. R., & Narvaez, D. (1999). Beyond the promise: A perspective on research in moral education. *Educational Researcher*, 28(4), 18-26. doi:10.2307/1176445
- Bereiter, C., & Scardamalia, M. (1985). Cognitive coping strategies and the problem of "inert knowledge". In S. F. Chipman, J. W. Segal & R. Glaser (Eds.), *Thinking and learning skills: Current research and open questions* (Vol. 2, pp. 65-80). Hillsdale, NJ: Erlbaum.
- Blasi, A. (1980). Bridging moral cognition and moral action: A critical review of the literature. *Psychological bulletin*, 88(1), 1. doi:10.1037//0033-2909.88.1.1
- Bloom, B. S. (1984). The 2 sigma problem: The search for methods of group instruction as effective as one-to-one tutoring. *Educational Researcher*, 13(6), 4-16. doi: 10.2307/1175554
- Bransford, J. D., & Schwartz, D. L. (1999). Rethinking transfer: A simple proposal with multiple implications. In A. Iran-Nejad & P. D. Pearson (Eds.), *Review of research in education* (Vol. 24, pp. 1-19). Washington, DC: American Educational Research Association.
- Broadbent, D.A. (1958). *Perception and communication*. New York, NY: Pergamon.
- Carter, J. (2005). *Our endangered values: America's moral crisis*. New York, NY: Simon and Schuster.
- Dewey, J. (1922). *Human nature and conduct*. New York, NY: The Modern Library.
- Donoghue, J. P., Nurmikko, A., Black, M., & Hochberg, L. R. (2007). Assistive technology and robotic control using motor cortex ensemble-based neural interface systems in humans with tetraplegia. *The Journal of physiology*, 579(3), 603-611. doi: 10.1113/jphysiol.2006.127209

- Drack, M., Apfalter, W., & Pouvreau, D. (2007). On the making of a system theory of life: Paul A. Weiss and Ludwig Von Bertalanffy's conceptual connection. *The Quarterly Review of Biology*, 82(4), 349-373. doi:10.1086/522810
- Gomez, E. A. (1996). Radical constructivism and narrative. *Journal of the American Academy of Psychoanalysis and Dynamic Psychiatry*, 24(1), 1-14.
- Greene, J., & Haidt, J. (2002). How (and where) does moral judgment work? *Trends in Cognitive Sciences*, 6(12), 517-523. doi:10.1016/S1364-6613(02)02011-9
- Haidt, J. (2003). The emotional dog does learn new tricks: A reply to Pizarro and Bloom (2003). *Psychological Review*, 110(1), 197-198. doi:10.1037//0033-295X.110.1.197
- Haque, O. S., & Waytz, A. (2012). Dehumanization in Medicine Causes, Solutions, and Functions. *Perspectives on Psychological Science*, 7(2), 176-186. doi:10.1177/1745691611429706
- Iran-Nejad, A. (2000). Knowledge, self-regulation, and the brain-mind cycle of reflection. *The Journal of Mind and Behavior*, 21, 67-88.
- Iran-Nejad, A. (2012, May 24-27). *Affect, self-regulation and moral behavior in body-mind cycle of reflection*. Paper presented at the Association for Psychological Science Annual Convention, Chicago, IL.
- Iran-Nejad, A., & Bordbar, F. (2013). The paradox of the missing function: How similar is moral mutualism to biofunctional understanding? *Behavioral and Brain Sciences*, 36(1), in press.
- Iran-Nejad, A., & Chissom, B. S. (1992). Contributions of active and dynamic self-regulation to learning. *Innovative Higher Education*, 17, 125-136. doi: 10.1007/BF00917134
- Iran-Nejad, A., & Gregg, M. (2001). The brain-mind cycle of reflection. *Teachers College Record*, 103, 868-895.
- Iran-Nejad, A., & Gregg, M. (2011). The nonsegmental context of segmental understanding: A biofunctional systems perspective. *American Journal of Educational Studies*, 4(1), 41-60. doi:10.1113/jphysiol.2006.17209
- Iran-Nejad, A., & Ortony, A. (1984). A biofunctional model of distributed mental content, mental structures, awareness, and

- attention. *The Journal of Mind and Behavior*, 5, 171-210.
doi:10.1177/1745691611429706
- Iran-Nejad, A., & Stewart, W. (2011). First-person education and the biofunctional nature of knowing, understanding, and affect. In D. Ifenthaler, D. Kinshuk, P. Isaias, D. G. Sampson & J. M. Spector (Eds.), *Multiple perspectives on problem solving and learning in the digital age* (pp. 89-109). New York, NY: Springer.
- John, E. R. (1972). Switchboard versus statistical theories of learning and memory. *Science*, 177, 850-864.
doi:10.1126/science.177.4052.850
- Mandler, G. (2007). *A history of modern experimental psychology: From James and Wundt to cognitive science*. Cambridge, MA: MIT Press.
- Mayer, R. E. (1996). Learners as information processors: Legacies and limitations of educational psychology's second metaphor. *Educational Psychologist*, 31, 151-162. doi:10.2307/1175554
- Miller, J. (1978). *The body in question*. New York, NY: Random House.
- Nahmias, E., Morris, S., Nadelhoffer, T., & Turner, J. (2005). Surveying freedom: Folk intuitions about free will and moral responsibility. *Philosophical Psychology*, 18(5), 561-584.
doi:10.1080/09515080500264180
- Neisser, U. (1967). *Cognitive psychology*. New York, NY: Appleton-Century-Crofts.
- Neumann, A. (2006). Professing passion: Emotion in the scholarship of professors at research universities. *American Educational Research Journal*, 43, 381-424.
doi:10.3102/00028312043003381
- Pekarsky, D. (1982). Dehumanization and education. *Teachers College Record*, 84(2), 340-355. doi:10.1177/1745691611429706
- Prawat, R. S. (2000). Keep the solution, broaden the problem: Commentary on "Knowledge, self-regulation, and the brain-mind cycle of reflection". *The Journal of Mind and Behavior*, 21, 89-96.
- Renkl, A., Mandl, H., & Gruber, H. (1996). Inert knowledge: Analyses and remedies. *Educational Psychologist*, 31, 115-121.
doi:10.1207/s15326985ep3102_3

- Rest, J. R., Narvaez, D., Thoma, S. J., & Bebeau, M. J. (2000). A neo-Kohlbergian approach to morality research. *Journal of Moral Education, 29*, 381-395. doi:10.1080/713679390
- Roediger, H. L. (1980). Memory metaphors in cognitive psychology. *Memory & Cognition, 8*(3), 231-246. doi:10.3758/BF03197611
- Rosenshine, B., Meister, C., & Chapman, S. (1996). Teaching Students to Generate Questions: A Review of the Intervention Studies. *Review of Educational Research, 66*(2), 181. doi:10.2307/1170607
- Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. Basic Books.
- Schön, D. A. (1987). *Educating the reflective practitioner*. San Francisco, CA: Jossey Bass.
- Shulman, L. S. (1999). Taking learning seriously. *Change: The Magazine of Higher Learning, 31*(4), 10-17.
- Smith, G. (2012, March 14). Why I Am Leaving Goldman Sachs, *The New York Times*. Retrieved from http://www.nytimes.com/2012/03/14/opinion/why-i-am-leaving-goldman-sachs.html?_r=2&pagewanted=all
- Sweller, J., Van Merriënboer, J. J. G., & Paas, Fgwc. (1998). Cognitive architecture and instructional design. *Educational Psychology Review, 10*, 251-296. doi:210.1023/A:1022193728205
- Weiss, P. A. (1949). The Biological basis of adaptation. In J. Romano (Ed.), *Adaptation*. Ithaca, NY: Cornell University Press.
- Zengaro, S. A. (2010). *Biofunctional embodiment of moral development: The impact of affect, moral cognition, maturation and experience playing sports on acceptance of aggression in sports by Italian adolescents* (Doctoral Disstertation), University of Alabama, Tuscaloosa, AL.

Asgar Iran-Nejad is professor in the Department of Educational Studies in Psychology, Research Methodology and Counseling at The University of Alabama.

Contact Address: The University of Alabama, 306 Carmichael Hall, Box 870231, Tuscaloosa, AL 35487, (205) 348-7575.
E-mail: airannej@bamaed.ua.edu