

Virtue Ethics, Positive Psychology, and a New Model of Science and Engineering Ethics Education

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Abstract This essay develops a new conceptual framework of science and engineering ethics education based on virtue ethics and positive psychology. Virtue ethicists and positive psychologists have argued that current rule-based moral philosophy, psychology, and education cannot effectively promote students' moral motivation for actual moral behavior and may even lead to negative outcomes, such as moral schizophrenia. They have suggested that their own theoretical framework of virtue ethics and positive psychology can contribute to the effective promotion of motivation for self-improvement by connecting the notion of morality and *eudaimonic* happiness. Thus this essay attempts to apply virtue ethics and positive psychology to science and engineering ethics education and to develop a new conceptual framework for more effective education. In addition to the conceptual-level work, this essay suggests two possible educational methods: moral modeling and involvement in actual moral activity in science and engineering ethics classes, based on the conceptual framework.

Keywords Ethics education · Virtue ethics · Positive psychology · Moral modeling · Moral activity

Introduction

Recently, positive psychology has become one of the most prevalent trends in the field of moral educational studies, including moral philosophy, moral psychology, and moral education. Unlike previous moral educational paradigms, which have emphasized rule-based ethics and preventive moral education, recent positive psychological moral education underscores that moral education should serve for

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students' flourishing and authentic happiness (Davidson et al. 2008). This new trend contends that future moral education should contribute to the promotion of students' wellness in physical and mental domains. Inspired by this new trend, a significant group of moral philosophers, psychologists, and educators have started paying attention to the new trend, which emphasizes positive aspects of the moral development of students instead of its pathological aspects, and seems to better contribute to the mental wellbeing of the recent students in the long run.

However, a group of moral philosophers, particularly virtue ethicists, have significantly criticized this trend; these ethicists have argued that the current form of positive psychology can hardly be a new framework of moral education. It would sound weird, because both virtue ethicists and positive psychologists seem to pursue happiness as the final aim of moral education. It is obvious that the ultimate goal of positive psychologists is the maximization of perceived happiness (Seligman and Csikszentmihalyi 2000). Virtue ethicists have also sought the way to achieve happiness in our life since Aristotle. Aristotle significantly underscored the realization of *eudaimonia*—that is, flourishing—as the ultimate goal of human life, and *eudaimonia* can be achieved through the internalization and implementation of moral virtue (Aristotle 2009). Thus, the vantage point of virtue ethicists seems to correspond well to that of positive psychologists. Nevertheless, it is not the case given the fact that the current virtue ethicists are not merely happy with the application of positive psychology to moral education. I shall briefly review their criticism.

First, the current positive psychology does not seriously consider its objective aspect; instead, the core of happiness defined by positive psychology is fundamentally subjective (Seligman and Csikszentmihalyi 2000). Positive psychologists emphasize the importance of positive psychological traits, such as resiliency (Fredrickson 2001), for psychological wellbeing; however, they are basically amoral, and cannot be moral virtues from the perspective of virtue ethicists (Kristjánsson 2010). For instance, can I say that a strong psychological resiliency of a gang leader is morally admirable, and present this trait as an example of moral virtue in moral education class? No, I cannot. Second, in terms of the cultivation of the positive emotions, which is a core educational component of positive psychology (Seligman et al. 2009), the conflict between the cultivation of moral virtues and both immediately (e.g., joy) and obliquely pleasant positive emotions (e.g., flow) would be problematic. In fact, in the case of the cultivation of immediately pleasant emotions, the cultivation of moral virtues frequently requires the experience of negative, but morally meaningful emotions, such as moral indignation; in addition, in case of the education of obliquely pleasant positive emotions, positive psychology educators cannot prevent students who are seeking immoral, self and other-destructive flow. Thus, virtue education would hardly be compatible with the cultivation of positive emotions in the current positive psychology (Kristjánsson 2012a). Finally, the current positive psychology does not take account *phronesis* (practical wisdom) into the process of positive emotions. In virtue ethics, *phronesis* as a meta or second-order intellectual virtue is crucial, because it guides other first-order virtues, emotional traits, and dispositions to a morally appropriate direction, and let them morally and appropriately work in

practice (Carr 1996). However, usual positive psychology-based education merely focuses on the training of emotional traits, and seems to neglect this rational and moral component, *phronesis* (Carr 2000), so it would be problematic and cannot be morally justifiable from the vantage point of virtue ethics.

However, although a naïve positive psychological approach to moral education cannot be justified, I will not completely discard positive psychology, in this essay, because empirical inquiries, such as the development of measurements and the statistical analysis of the effect of educational interventions, are required to design a practical model of moral education. In other words, although moral philosophy can answer what is the ultimate goal of, and what should be taught in moral education, other fundamental questions, “How should we teach?” and “What is an effective educational method to induce moral development?” would be answered by psychological studies. Therefore, I shall present the *eudaimonic* positive psychological approach to moral education, in place of the current positive psychological approach. Particularly, this essay will focus on the concept of purpose, which underscores the moral aspect of positive traits and human life (Damon 2008), instead of mere, subjective happiness in the current amoral positive psychology, as the goal of moral education. I expect that the concept and psychological account of purpose, instead of those of mere happiness, which have been studied by the current positive psychology, would better correspond to virtue ethics, and would provide us with better insights about how to organize a better moral educational method with its empirical methodology and finding.

In fact, this new trend has also influenced the field of science and engineering ethics, although its influence on the field appears limited. Of course, I appreciate previous endeavors to apply these perspectives, positive psychology and virtue ethics, to science and engineering ethics education. Some scholars in the fields of science and engineering contend that moral education for students who pursue careers in science and technology should also seriously consider the positive approach in moral education, instead of a negative, preventive moral educational approach (Harris 2008; Stovall 2011). In addition, I expect this trend would contribute to the development of a more effective educational method for science and engineering ethics because employing the concept of virtue, which is more closely associated with positive psychological approach than rule-based morality, better connects moral virtue and professional virtue for a happy and flourishing scientist or engineer who is admired by students (Harris 2008). It means that while the previous paradigm of science and engineering ethics education, which concentrated on rule-based ethics education, would be difficult to form a significant, strong, and direct conceptual connection between professional ethics and a successful career as virtues for being a successful scientist or engineer, this virtue-based positive approach to ethics education would easily associate the content of ethics education and professional career development.

However, there have been few practical considerations about how to apply a positive psychological approach to science and engineering ethics education based on virtue ethics. The majority of previous studies regarding science and engineering ethics based on virtue ethics did in fact deal with its moral philosophical aspect, but did not seriously consider its educational psychological aspect. Because ethics education is a practical activity that influences students’ development, to maximize

its effectiveness and to measure its outcomes, an empirical and social scientific approach, particularly a moral psychological approach, is strongly necessary, while moral philosophical accounts provide ethics education with its overall direction and philosophical justification (Han 2014). Meanwhile, previous research of positive psychological approach to ethics education would also be limited due to its lack of moral philosophical justification, as presented in moral philosophical criticisms of positive psychology that I briefly reviewed. If moral educators merely rely on psychology without any moral philosophical consideration, although the empirical outcome of the educators' teaching would be statistically significant, it would be very difficult to answer this question: "Does the statistically significant result of educational endeavors mean that students' significant psychological development is oriented to a morally appropriate and justifiable direction?" It is why "moralized psychology" and moral philosophical accounts on moral psychology are necessary in moral education (Carr 2007). Therefore, I shall carefully consider both the philosophical and psychological aspects of science and engineering ethics education in this essay.

Thus this essay will consider how to apply virtue ethics and positive psychology to science and engineering ethics education at the conceptual level. By critically considering the moral philosophical basis of positive psychology with virtue ethics, and seeking scientific and psychological methods that would contribute to the effective implementation of moral philosophical ideas in ethics education from positive psychology, this essay would provide a moral philosophically appropriate as well as psychologically effective ethics education program to educators. Although previous studies have attempted to do so, because few of them have seriously considered both moral philosophical and moral psychological accounts, this essay would provide better insights. First, I shall review the theoretical framework of Aristotelian virtue ethics, which is the basis of mainstream virtue ethics, while focusing on the relation between virtue and human flourishing. As I previously discussed, because there have been serious virtue ethical criticisms of the positive psychological approach to moral education, I shall seek a morally justifiable way to apply the perspective of positive psychology to moral education by considering *eudaimonic* positive psychology, which is based on the concept of purpose, instead of mere happiness. Second, based on the review of virtue ethics, this essay will consider how to apply virtue ethics and positive psychology to science and engineering ethics at the conceptual level. Finally, I shall suggest several possible ways to implement this moral educational approach in schools. Given the fact that moral philosophy and psychology are significantly associated with each other at the theoretical level (Jeong and Han 2012), this essay, which attempts to apply the integrative perspective to science and engineering education, will provide valuable inspiration to educators.

Moral Philosophical Consideration of Positive Psychology

The recent trend of positive psychology has greatly influenced the theory and practice of education in general. Recently, the main goal of positive psychological

education has become the pursuit of happiness. For instance, positive psychologists contended that the way to wellbeing should be taught in all aspects of school education; in addition, they reported that well-being can be taught and promoted in classrooms with educational interventions (Seligman et al. 2009). As a result, moral psychologists and educators started seeking ways to connect the idea of positive psychology, positive development, and character education in schools and investigating psychological and educational effects of this new educational approach (Catalano et al. 2008; Davidson et al. 2008). For instance, character educators provided students with moral mentoring and supportive environments to promote their moral development (Clonan et al. 2004).

However, there have been several moral philosophical criticisms to this educational approach aimed at the promotion of happiness and well-being in the field of positive psychology. These criticisms are mainly presented by virtue ethicists as I reviewed in the previous section. In addition to the reviewed criticisms, I shall particularly concentrate on the moral philosophical problems of positive psychology that can potentially hinder me from applying a positive psychological perspective to science and engineering education. One of the most impactful arguments is that, without moral philosophical considerations, the pursuit of happiness and well-being cannot be morally justifiable in some cases (Kristjánsson 2013). In other words, although the mere pursuit of happiness emphasized by mainstream positive psychology, which does not have a firm moral philosophical foundation, can be helpful to promote subjective happiness, it cannot necessarily contribute to objective well-being and human flourishing, which needs moral justification from the objective and universal perspective. If the moral philosophical aspect is being associated with the definition of happiness, then pure hedonic activities that can cause self-destruction or threat to others cannot be a way to flourish, which is a sort of morally appropriate form of happiness. For instance, sadistic behaviors that threatens another's happiness and welfare would enhance a sadist's subjective happiness and be acceptable, if we merely evaluate the degree of happiness with subjective measures; however, it cannot be morally justifiable and cannot be acceptable from a common-sense point of view. Thus the justification of subjective happiness from the objective standpoint of universal moral principle would be the most problematic point in the connection between positive psychology and moral educational studies (Kristjánsson 2010).

To cope with the criticisms from moral philosophers, positive psychologists have attempted to reconstruct the definition of happiness and to establish a more sophisticated concept of happiness; that is, authentic happiness. They proposed that meaningfulness is an essential component of authentic happiness (Seligman 2011); it means that not only subjective happiness in the previous version of positive psychology, which is close to hedonic feelings, but also meaningfulness of life are necessary to achieve more valuable happiness. Of course, because this new definition cannot also be fully morally justifiable in some extreme situations, a more moral philosophically developed concept has been suggested by virtue ethicists. In addition to the mere meaningfulness, Damon (2008) argued that a purpose and meaning of life that we pursue should be morally noble and admirable, and an immoral purpose is not acceptable. Again, as proposed by virtue moral

philosophers, the meaning of life, which is a component of a more sophisticated form of happiness, should also be morally and objectively justifiable to be an appropriate and acceptable one (Kristjánsson 2013). In short, given these moral philosophical and psychological accounts, both subjective and objective happiness are essential to define the concept of flourishing, and moral philosophical accounts are significantly associated with this concept.

As this essay proposed above, the recent, more sophisticated form of positive psychology has become inspired by the moral philosophical vantage point of Aristotle. The most important concept in Aristotelian virtue ethics is *eudaimonia*, which translates into “flourishing” in contemporary English (Bruni 2010). The ultimate goal, *telos*, of life is *eudaimonia*; it can only be achieved by the possession and internalization of moral virtue according to his moral philosophy (Aristotle 2009). However, the possession of moral virtue is not a sufficient condition for the achievement of *eudaimonia*; instead, it is a necessary condition. Indeed, a morally virtuous person could not be flourishing if his/her life is unfortunate and poor (Ostenfeld 1994). For instance, although the person always puts moral virtue into practice, he/she might not have good friends and enough money and might feel significant subjective unhappiness; as a result, this person could not experience subjective happiness, though his/her life is morally admirable and valuable from the objective perspective. Nevertheless, moral virtue is a necessary condition for a flourishing life, and, without this component, a person cannot achieve authentic happiness throughout his/her life, though he/she might be happy in a subjective manner. Indeed, happiness, particularly subjectively perceived happiness, without the possession and guidance of moral virtue cannot contribute to moral good and can be meaningless and even morally evil as proposed above (Kristjánsson 2013).

Then how does moral virtue enable us to achieve authentic, moral happiness? First, it motivates us to behave morally and to feel morally appropriate emotions corresponding to moral happiness (Kristjánsson 2013). One of the most important aspects of moral virtue that promotes moral motivation and moral emotion is *phronesis* (practical wisdom). A morally virtuous person can make a proper moral judgment and induce emotional responses toward a morally appropriate direction through the guidance of *phronesis*. Again, to formulate a morally appropriate disposition that needs appropriate moral judgment and moral emotion, *phronesis* is required (Silverstein and Trombetti 2013). Unlike the previous mainstream moral psychology, which was proposed by Kohlberg (1981) and his colleagues, Aristotelian moral theory emphasizes the role of *phronesis*-guided moral emotion in moral motivation and actual moral behavior. Since moral virtue with *phronesis* is a sort of stable disposition, and a source of appropriate moral judgment and moral emotion, it is not a mere reasoning ability, such as moral reasoning emphasized by the previous moral psychology; it provides us with external moral motivation, which exists out of the realm of moral reasoning (MacIntyre 2003; Wall 2003). And finally, with the presence of *phronesis* and moral virtue in our mind, we can enjoy great and deep satisfaction generated by autonomy, relatedness, and competence, which are guided by *phronesis* and moral virtue, and it leads to authentic happiness; that is, *eudaimonia* (Snow 2008).

Last, I shall discuss how to develop moral virtue and *phronesis* and to achieve *eudaimonia* at the end. Aristotle emphasized that habituation and internalization are the most important mechanisms of the acquisition of moral virtue throughout life (Kraut 2010). Particularly, early interventions to make children habituate moral virtue through involvement in actual moral activity are crucial to the further internalization of moral virtue and development of *phronesis* beyond childhood and adolescence. Again, to completely acquire moral virtue and achieve *eudaimonia* at the end, these early childhood interventions are essential; appropriate parenting attitude and home training are among the most effective ways to achieve this goal (Steutel and Spiecker 2004). Of course, a person who was unable to have enough changes to habituate moral virtue can still behave morally (McDowell 2003); however, this moral conduct does hardly originate from internalized moral virtue and hardly contributes to the achievement of *eudaimonia*. For instance, a conscientious person can behave according to her moral decision originated from the result of the moral reasoning process, but would experience emotional, internal conflict between moral decisions and other desires, so she would find it difficult to completely achieve *eudaimonia* while behaving morally. On the other hand, a person who successfully habituated and internalized moral virtue does not experience any emotional conflict between moral motivation and other desires because other thoughts are “silenced” and become *eudaimonically* happy at the end (McDowell 2003). Thus I shall again contend the importance of early parental and educational interventions aimed at the habituation and internalization of moral virtues to achieve the status of authentic happiness, *eudaimonia* in terms of virtue ethics, from the vantage point of virtue moral philosophy.

Connecting Virtue Ethics, Positive Psychology, and Science and Engineering Ethics Education

Given the moral philosophical accounts on *eudaimonia* and moral virtue, we shall discover the necessity of a careful consideration on the connectivity between positive psychology and moral education based on virtue ethics. Now this essay will introduce philosophical and psychological accounts on why this *eudaimonic* approach to moral educational studies is better for explaining and promoting moral motivation and actual moral behavior. First, we can consider the possibility of the “moral schizophrenia,” which would occur when a person attempts to seek the source of moral motivation from the moral justifications of modern moral philosophy, such as utilitarian moral philosophy and Kantian moral philosophy (Stocker 2003). Stocker argued that the pursuit of moral goals suggested by modern moral philosophy would deprive us of the possibility of a good and happy life because utilitarian and Kantian moral philosophical vantage points require us to behave for the sake of the utility of society (in the case of utilitarianism) or universal moral rule (in the case of Kantian ethics), while sacrificing other important elements that are crucial in our good and happy life, such as care and love; for instance, an altruistic behavior motivated by some moral affections, such as compassion, becomes morally inferior to that motivated by pure moral

principles given modern moral philosophical vantage points. As a result, the pursuit of moral goals detached from the pursuit of happiness, *eudaimonia* in terms of virtue ethics, would cause “moral schizophrenia” in our mind, according to Stocker’s argument.

Moral psychological studies that investigated the nature of moral exemplarity can support this moral philosophical account on why rule-based modern moral philosophy cannot properly explain moral motivation and the mechanism of moral behavior. Because moral exemplars that have successfully internalized moral virtues and put those virtues into practice are the reliable and valid examples of morally virtuous people in virtue ethics (Walker and Hennig 2004), moral exemplar studies would show us why we should seriously consider virtue philosophical accounts based on the concept of *eudaimonia* as the *telos* of life to avoid the possibility of moral schizophrenia during the course of moral education. For instance, a significant majority of twenty-three moral exemplars, qualitatively investigated in *Some Do Care*, reported that they usually did not consciously consider explicit moral norms and rules when they were continuously engaged in moral activities through their lives; instead, moral virtues were regarded as the most important part of their selfhood, and the exemplars reported that morality constituted the most central aspect of their self-concept. In addition, they experienced significant positive emotions, such as purposefulness and meaningfulness, instead of negative emotions, when they were realizing their moral beliefs; they also reported that the realization of moral virtue is the core aspect of their purpose or goal of life and the source of their emotional positiveness (Colby and Damon 1992). As a result, we shall conclude that their exemplary virtuous moral behaviors originated from their internalized and habituated moral virtues, instead of objective, external moral rules as presented by utilitarian or Kantian moral philosophy, and the practices of the behaviors did not induce moral schizophrenia in their minds, as warned by Stocker.

These findings of moral exemplar studies are in line with developmental psychological investigations on the development of the moral self. Previous psychological research of the development of the notion of the moral self through childhood and adolescence has illuminated that the development occurs while a person is integrating morality into her self-concept, and the importance and centrality of morality and moral virtue to the self-concept is increasing. In fact, a preschooler usually regards morality as something detached from herself, while a college student mentions that morality becomes one of the most important and central concepts that describe her self-concept (Damon 1984; Punzo 1996). In addition, the developed moral self, which can be represented by established moral identity, bridges the gap between moral judgment, moral motivation, and moral behavioral outcome; indeed, moral rule that underlies moral reasoning is not sufficient to induce actual moral behavior (Blasi 1984, 1995). In short, as the idea of moral schizophrenia suggests, external moral rules and norms themselves cannot directly produce a moral motivational force and moral action. Instead, moral virtue and morality should be integrated into one’s self-concept for the establishment of moral motivation; this process is crucial to achieve *eudaimonia* happiness, as Colby and Damon (1992) showed.

Second, the image of the moral ideal or “moral saint,” which has been depicted by either utilitarianism or Kantian moral philosophy, would not appear to correspond to the image of the “happy and flourishing” ideal from a common-sense point of view, according to virtue philosophical criticisms of modern moral philosophy (Wolf 2003). Wolf argued that moral saints who are defined in terms of modern moral philosophy would not seem to be attractive by ordinary people because they lack some important elements that constitute a happy life. For instance, this essay will consider the case of a person who cares for a friend who suffers from a severe disease. Wolf contends that if that person is regarded as a real moral saint from the perspective of utilitarianism or Kantian moral philosophy, then she must not be motivated by any affective or relative motivation, such as friendship or caring, but must be solely driven by pure will to conform to an external moral axiom, such as the maximization of utility (in case of utilitarianism) or a universal, categorical moral principle (in case of Kantian ethics). However, from Wolf’s vantage point, it is remote from our common sense. We, ordinary people, highly value sincere friendship and praise a person who really cares about and emotionally appropriately responds to a friend’s pain. Thus Wolf argued that a virtue moral philosophical approach seems to be more plausible to explain the nature of moral saints, and finally, that of human morality. Because moral virtue is a habituated and internalized moral disposition (Kraut 2010), which is associated with moral emotions and produces moral motivational force with the guidance of the rational aspect of human psychological processes, *phronesis* (Carr 2005), virtue ethics would provide us with a better theory to explain the mechanisms of human morality.

As shown above, moral exemplars that seem to approximate moral saints, and have been psychologically investigated, are basically affectionate rather than strict or objective and tend to empathize well with other people in need; also, these aspects of the moral exemplars have become the source of their emotional positiveness (Colby and Damon 1992). Given the psychological findings, we shall conclude that moral exemplars and moral saints are able to generate appropriate, rich moral emotions and are motivated by the moral emotions, but are not completely rule-driven and emotionless; it is in line with Wolf’s moral philosophical account that criticized the nature of moral saints, which was explained by mainstream modern moral philosophy (utilitarian and Kantian moral philosophy). Thus we should take account of this emotional aspect, which would correspond to positive psychology introduced in the previous section, which is based on virtue philosophy and emphasizes the importance of not only hedonistic, but also *eudaimonic* happiness, when we consider the nature of exemplary morality, which should be pursued during the course of moral education.

Given these moral philosophical and psychological discussions, this essay contends that science ethics education, which is a part of moral education for professions, should carefully consider the *eudaimonic* approach toward morality and moral education, which is based on virtue ethics and *eudaimonic* positive psychology, rather than the usual rule-based moral educational approach, to maximize the effect of education, in terms of the promotion of moral motivation and moral behavior. In fact, by recognizing that morality is a central and crucial

part that constitutes self-concept, and is also a central element that defines the notion of true happiness, people will be able to minimize internal psychological conflicts between moral purposes and self-oriented desires when they encounter moral dilemmas. As proposed by moral psychologists, a person who truly integrates moral virtue and morality in the core part of her self-concept will experience negative emotions when she betrays her moral virtue for her own, hedonistic sake because the virtue and morality have become the core element that defines her selfhood, and the betrayal of those moral values now means the betrayal of her own selfhood; instead, moral ends have been fused into her selfhood, so practicing moral virtue is now the main way to achieve true happiness for her (Blasi 1993; Walker 2013).

However, in the field of science and engineering ethics, scholars have not frequently conducted research of ethics education methods based on virtue ethics and positive psychology. In fact, a recent article published in *Science and Engineering Ethics*, which provides an overview of current science and engineering ethics education in colleges, mentioned that the majority of the endeavors of science ethics education has concentrated on teaching moral rules, such as moral principles in the field of science and engineering, rather than on the aspect of moral virtue for scientists and engineers (Zandvoort et al. 2013). In addition, one of the most significant issues in the field is the perceived conflict between moral values, such as responsibility, and scientific or career values; many scientists, engineers, and students would frequently encounter this problem during the course of their research conduct, and it would significantly increase cognitive and emotional costs in their psychological processes (Dunbar 2005). As a result, professionals would hesitate to put their moral beliefs and moral decisions into practice when they encounter moral dilemmas, although they might make an appropriate moral decision at the conceptual level as warned by traditional moral psychologists, who investigated the moral self (Blasi 1980), due to the issue of the perceived conflicts and increased cognitive and emotional costs. Given this fact and the nature of the mainstream science ethics education, which is significantly inspired by rule-based moral philosophy, the current paradigm in this field would not be effective to promote moral motivation and induce actual moral behavioral outcome among professions. Thus, by applying the framework proposed in this section—that is, positive psychology guided by virtue ethics in moral education—we will be able to connect morality to *eudaimonic* and hedonistic happiness while effectively coping with several previous concerns, such as moral schizophrenia during the course of moral education, and strong cognitive and emotional conflicts perceived by professionals when they encounter moral dilemmas in the fields of science and engineering. The definition of a moral goal would be redefined in terms of self-regarding and happiness in accordance with the idea of virtue ethics and *eudaimonic* positive psychology, and the application of this redefined concept to ethics education would promote students' motivation for moral behavior because moral behavior will be regarded as the most important way to strengthen perceived happiness. Therefore, this essay will suggest practical educational methods based on this theoretical framework to enhance the effectiveness of science and engineering ethics education in the next section.

How to Improve Science and Engineering Ethics Education?

Then what are the ways to apply the newly suggested framework of moral education to science and engineering ethics education? As proposed by virtue moral philosophers and psychologists, the most important way to develop a person's morality in terms of virtue ethics is the cultivation of moral virtue through the early habituation and internalization of moral virtue. Because moral virtue is a sort of disposition, and a disposition is continuously constructed through the history of development from the past to future, it is important to instill moral virtue into the students' self-concept and make virtue the most crucial and central psychological element in their self-concept in moral education based on virtue theory (Fowers 2005). Likewise, educators in the field of science and engineering ethics can try to instill core moral virtues in the field of science and technology to science and engineering majoring students. Thus this essay will consider how to apply the idea of virtue ethics and positive psychology to the current science and engineering ethics education.

First, we should consider an educational method to create a firm connection between moral virtues required in the field of science and engineering and students' *eudaimonic* flourishing as successful scientists or engineers in the future. As introduced in the previous section, students and professionals would frequently experience conflicts among moral, scientific, and career values if they defined morality with rule-based moral philosophy. Thus students can obtain psychological benefits by reconsidering their previous belief in morality and science ethics using the theoretical framework of virtue ethics and positive psychology, which enables them to connect morality and flourishing. Then what would be a possible way to enable students to reconsider their notion of morality and moral values and to think that those moral ends can contribute to their flourishing as successful and morally admirable professions? One possible method is moral emulation through moral modeling. The effect of a moral model has been suggested by social psychologists. Several social psychological studies showed that the existence of a moral model is crucial for early moral development, and social reinforcement alone is not enough to induce significant development (Bandura and McDonald 1963; Bandura 1969). The presence of a moral model promotes upward social comparison and enhances the motivation for self-improvement and imitation among observers (Schnall et al. 2010). In addition, by causing the sense of moral inspiration and moral elevation, watching a morally better person promotes moral motivation for various moral behaviors (Haidt 2000), such as maternal caring and nursing (Silvers and Haidt 2008), fair and altruistic leadership (Vianello et al. 2010), prosocial behavior (Algoe and Haidt 2009), and antidiscrimination activity (Freeman et al. 2009). However, the mere presentation of a moral model does not always produce positive outcomes. For instance, several social psychological experiments reported that after listening to stories of distant and nonrelevant moral saints, participants experienced negative emotional states, such as moral resentment, and showed morally negative behavioral tendencies (Monin et al. 2008; Monin 2007).

Then how can moral educators cope with this problem of moral modeling and properly apply moral modeling method to science and engineering education? From

the perspective of virtue moral philosophy, the self-related aspect of a presented moral model is crucial to induce moral emulation. A person has to critically consider reasons about why she should emulate the presented moral model and to pass the processes of authentic self-understanding and rational self-persuasion (Kristjánsson 2006). In fact, the presentation of relevant exemplars is the only way to effectively promote the motivation of self-improvement among participants given the result of social psychological experiments. For instance, college students showed significant signs of self-improvement when they watched exemplars in their major field; this effect was not reported by another group of students who watched nonrelevant exemplars (Lockwood and Kunda 1997). Given these philosophical and psychological accounts, we shall conclude that only relevant exemplars can produce positive outcomes. Thus, educators in the field of science and engineering ethics should consider how to introduce moral exemplars in the field of science and engineering, particularly those who are flourishing as professionals and keeping moral excellence as well. The real stories of moral exemplars in the field can be introduced and used as the sources of moral inspiration. In addition to the introduction of moral exemplars, educators can invite successful scientists and engineers who put moral virtues, such as scientific authenticity and social responsibility into practice, and let them provide mentoring to students. According to a seminary exemplar study, the most effective way to strengthen students' noble purposefulness is a mentorship between real exemplars and students (Damon 2008). Exemplary mentors can give advice about how to realize moral values during the course of scientific research to students, and students can get practical solutions on how to cope with potential moral dilemmas in the future. Therefore, through this method, i.e., the application of moral models, students will have chances to connect moral and career values and realize that practicing moral virtue as professionals enable them to achieve authentic happiness—that is, *eudaimonia*—in their lives as scientists and engineers.

Of course, the application of a relevant model and moral emulation has been proposed as an educational method in the field of science and engineering ethics education (Harris 2008; Kenny et al. 2003). However, the majority of the previous research has concentrated on either moral or professional excellence in models; it has not seriously and systematically considered how to integrate morality and flourishing as a professional during the course of emulation. Thus, this essay suggests a flourishing, purposeful model in the field as an exemplar who can successfully integrate those two aspects in his/her self-identity. By utilizing this *eudaimonically* flourishing model, moral emulation in science and engineering ethics education would be more persuasive and effective compared with previous science and engineering ethics education. In addition, social and developmental psychological aspects and mechanisms of emulation have not been applied in the previous, moral philosophy-centered research of emulation. So, this essay, which utilizes an integrative, interdisciplinary conceptual framework of virtue ethics and *eudaimonic* positive psychology, would propose a more psychologically effective way to apply emulation to science and engineering ethics education.

Second, the early habituation of moral research conduct is another way to apply the idea of virtue ethics and positive psychology to science and engineering ethics

education. As this essay proposed earlier, habituation is the most important way to enhance moral virtue, according to virtue ethics and *eudaimonic* positive psychology (Aristotle 2009; Kristjánsson 2013). In the field of moral psychology and moral education, providing changes to participate in actual moral action to students has also been regarded as an important element of effective and meaningful moral and character education (Lickona 1996). Thus this essay will consider how to apply this activity-based education method to science and engineering ethics education programs. Educators can utilize Institutional Review Board (IRB) processes to enable students to be involved in a moral activity that is directly related to their future career as professionals. Because the IRB is presumed to reflect norms and standards of the communities of scientists and engineers (Rosnow et al. 1993), by practicing and involving in its processes, students can learn what are important actual moral values in their field that they should possess and follow and exercise morally appropriate research conducts. If a certain student (e.g., a student majoring in mathematics) does not seem to have any chance to become involved in the IRB process in the future, then we can give her chances to practice another type of research ethics-related activity, such as a mock student research-integrity committee discussion and practical decision making on research integrity and misconduct issues (Mitcham 2003; Pimple 2002), in classes. In fact, these activities, which enable students to be involved in ethical, autonomous decision-making activities, have been suggested as an effective moral educational method to promote their moral development in ordinary primary and secondary schools (Power 1988; Power and Makogon 1995); by doing so, students can internalize moral values embedded in the activities and make those values important and central to their selfhood as proposed by virtue theorists. This activity-based method would also contribute to the formation of a connection between moral virtue and *eudaimonic* happiness in a student's mind as the moral modeling method does. Students will habituate and internalize moral virtue embedded in those activities and then eventually feel that the moral processes and moral values are somewhat natural and valuable to them. Thus this activity-based education will prevent students from experiencing the sense of conflict between moral and career values in the future in consort with the moral modeling method.

In fact, this virtue habituation through the involvement to practical moral activity has been suggested as an educational method in the field of science and engineering ethics education. Several moral philosophical articles inspired by virtue ethics have suggested that moral activities that are relevant to students' majors, such as natural sciences and engineering, can significantly contribute to the development of their moral virtues in the dimension of professional ethics (Harris 2008; Schrag 2005; Stovall 2011). However, there have been several practical limitations among these previous works. First, they have not seriously considered the moral psychological and developmental aspects of virtue habituation through moral activities; they have concentrated on moral philosophy and a conceptual framework. It might limit the effects of the educational method based on moral philosophy in terms of moral development and developmental psychology; given the fact that moral education is a practical endeavor that should be based on empirical and scientific inquiries (Han 2014), it would weaken the applicability of the educational method in practice. Of

course, some of them referred to moral developmental theory to consider the effect of the educational model (Schrag 2005); there have been few researches that seek the way to apply *eudaimonic* positive psychology, instead of traditional rule-based moral psychology, to ethics education. Thus, this essay may be helpful to overcome the limitation of the mere moral modeling method proposed by previous research by using the purposeful modeling method based on *eudaimonic* positive psychology. Second, the previous works have not proposed how to integrate morality embedded in moral activities and flourishing as a successful scientist or engineer during the course of instruction. Because students would not be sure about whether moral activities will really contribute to their successful career and flourishing at the end, the mere application of activities in the previous works would not effectively persuade students to prioritize and internalize moral virtues in their selfhood. Thus, by proposing the framework of *eudaimonic* positive psychology, and suggesting how to apply this purpose-based approach to virtue habituation through moral activities, this essay could provide useful insights to educators.

Now I shall consider whether these educational methods based on virtue ethics are congruent with the scientific evidence. Both behavioral and neuroscientific data support the effects of the educational methods inspired by the idea of virtue habituation and internalization suggested by this essay; the findings of previous empirical studies have shown that education and other sociocultural backgrounds that enable subjects to habituate morality significantly changed their behavior and neural activity. First, there have been several behavioral-level investigations that demonstrated significant behavioral changes as the result of the habituation and training of morality. Character Education Partnership, for example, analyzed the behavioral effects of character education programs, which included various activities to encourage students to become involved in and to practice moral behavior, and it reported that the majority of those programs significantly promoted students' prosocial behaviors and decreased the rate of antisocial and risky behaviors (Berkowitz and Bier 2005). In addition, an experimental study reported that college students who engaged in community service work showed a significant development in moral judgment and school participation compared with that of a control group student. The theoretical basis of this experiment was inspired by the idea of Aristotelian virtue moral philosophy, which emphasizes the habituation of moral virtue through practicing moral conduct (Boss 1994).

In addition to the results of those behavioral studies, several neuroimaging findings support the fact that training in the domain of morality that enables people to habituate and internalize morality can influence underlying neural activity. First, a cross-cultural investigation on the neural substrate of the moral decision-making process reported that Korean participants showed significantly stronger neural activity in the post-central sulcus associated with mental calculation under the familiar problem context than did American participants. Because Korean participants have taken moral education classes for nine to 12 years during their childhood and adolescence, they would habituate formal moral problem solving, and it would be reflected in significant neural activity in the brain region associated with familiarity (Han et al. 2014). In addition, the enhanced moral competence was positively correlated with the decreased neural activity in the dorsolateral prefrontal

cortex (DLPFC) associated with cognitive control (Prehn et al. 2008). Given this result, the enhanced moral competence that represents the habituated and trained moral judgment would change the neural substrate of cognitive control; it would also mean that a person who has successfully habituated and internalized sophisticated moral judgment does not experience significant emotional conflicts when she is solving moral dilemmas and does not have to strongly rely on the cognitive control process to protect a moral decision from other self-oriented ends.

Given behavioral and neuroscientific findings, I shall conclude that the habituation and internalization of morality and moral virtue can virtually change people's behavior and neural activity. Suggested methods—moral modeling and activity involvement—can induce significant moral development among students given those findings. Finally, this essay contends that its educational approach to science and engineering ethics education inspired by virtue ethics and positive psychology can have an influence on professionals and students' motivation for moral behavior at the behavioral and neural levels.

However, although moral modeling and virtue habituation are core educational methods in virtue ethics, their mere application cannot be morally justified. As I introduced, virtue ethicists have argued that simple positive psychological education lacks the cultivation of *phronesis*, which works as the practical and moral guidance in practice, and it would be problematic in moral education (Carr 2000). If this rational component does not accompany modeling and habituation, it would result in indoctrination, instead of education, as argued by the proponents of moral reasoning education (Kohlberg 1978). Thus, educators should think about how to cultivate students' practical wisdom while utilizing moral modeling and virtue habituation in their science and engineering ethics class. Now, how can this be implemented in a moral education class? The combination between the role model and habituation-based teaching and student-initiated discussion would be a possible way (Kristjánsson 2002). Students can actively and critically evaluate the moral and professional excellence, the behavior of a presented exemplar, and moral activity that they participated in. They may discuss which and to what degree virtues are exercised by exemplars, and what is the underlying reason why the exemplars made such a decision in a dilemmatic situation in the field. The students may also talk about how the exemplars could integrate their self-identity as professionals and morality, and achieve their admirable morality as well as professional purpose in the field. In the case of the discussion of moral activity, students may critically think about which virtue they could learn from and which component or part should be improved in the activity. By doing so, students would develop their practical wisdom to make an appropriate decision in a dilemmatic situation in the field, by critically and spontaneously considering the virtue and wisdom embedded in given exemplars and activities, while avoiding the pitfall of unidirectional indoctrination. One point that educators should note is that the discussion should not be moral rule-oriented; instead, it should deal with presented virtuous professional exemplars, and concrete moral activities that students experienced. In fact, according to virtue ethics and *eudaimonic* positive psychology, students should develop their moral trait, practical wisdom, and purpose (Kristjánsson 2002; Lerner 2008); increases in the knowledge of moral rules are not the most urgent issue in this paradigm. If

educators concentrate on moral rules, instead of purposeful exemplars or activities, during discussion, then it would result in students' decreased interest in the ethics class, and even cause their moral schizophrenia (Stocker 2003).

Conclusion

This essay attempted to develop a more effective education model for science and engineering ethics education based on the idea of virtue ethics and positive psychology. This new approach would be promising because its theoretical basis, virtue ethics, and positive psychology can provide us with useful inspirations for coping with the weak points of current ethics education. As criticized by virtue ethicists, the current moral philosophy has not given enough attention to one of the most crucial independent elements in the mechanism of moral function and moral behavior; that is, moral motivation. Unfortunately, previous moral theories based on moral reasoning did not seriously consider moral motivation as an independent element that determines moral conduct (Kristjánsson 2012b). Thus, this essay's theoretical framework will contribute to the solution of problems in the current moral philosophy and education, such as moral schizophrenia, as the result of the mere pursuit of rule-based moral philosophy, which can threaten motivation for actual moral behavior, by redefining the concept of morality to be more compatible with human nature, which typically pursues happiness and flourishing (Stocker 2003). Because the importance of moral commitment and moral motivation indeed have been acknowledged by moral philosophers in the field of science and engineering ethics (Martin 2002), the conceptual basis of this essay, virtue ethics, that emphasized the role of moral motivation in moral conduct and moral education among professionals would correspond well to this trend in the field.

Moreover, positive psychology can illuminate what we should consider to promote this aspect of morality: moral motivation. Unlike previous moral educational theories, which have concentrated on rule-based morality, positive psychology, particularly its current *eudaimonic* version, suggests that moral motivation can be effectively promoted by seriously considering the concept of *eudaimonia* as the ultimate *telos* of moral life (Kristjánsson 2013). Therefore, the framework of science and engineering ethics education based on virtue ethics and positive psychology suggested in this essay will provide a useful inspiration to educators who aim toward developing more effective educational methods for students. It will help alleviate possible conflicts between moral and career values that students will experience in the future and threaten their motivation to put their moral beliefs into practice by connecting morality and flourishing as successful scientists or engineers. Two suggested methods, moral modeling and practicing ethical research conduct, would be good starting points for developing new educational methods.

Of course, these educational methods would not be new in the field of science and engineering ethics education. As I discussed in the previous section, there have been several published articles suggested moral emulation and virtue habituation

through moral activities for science and engineering major students from the perspective of virtue ethics. However, I shall mention that there is a reason why the educational methods suggested in this essay made an advance from the previous works. The point is that this essay attempts to integrate virtue ethics and positive psychology to make a better model of moral education. Because previous works were based on moral philosophy, and psychological aspects were not seriously considered by them, the practical effectiveness of the educational methods would be limited from the vantage point of educational psychology. Since moral education is an educational endeavor that is moral philosophical as well as moral psychological, the application of a psychological perspective in this essay would be informative and meaningful. In addition, this essay suggests purpose as the core concept of moral models and activities. By utilizing purposeful and flourishing moral exemplars and moral activities in the field that can provide students with a chance to associate their purpose as a successful scientist or engineer and morality, moral modeling and moral activity methods would be more persuasive and effective as compared with their previous education which usually relied on mere relevant moral exemplars and activities.

However, this essay has several limitations. First, the effects of the suggested educational methods have not been tested. Because this essay concentrated on the establishment of the theoretical and conceptual framework for science and engineering ethics education based on virtue ethics and positive psychology, it did not conduct any empirical study to test the educational methods. Moreover, my suggestion of educational methods was basically conceptual and based on the conceptual aspects of virtue ethics and positive psychology; more practical educational methods other than those suggested should be developed based on the conceptual framework of this essay. Thus, to address those limitations, future research, particularly educational psychological studies, should be conducted by moral psychologists and educators.

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