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Environmental Enrichment and Substance Use Disorders

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CERTIFICATE OF APPROVAL

CAPSTONE PROJECT

Environmental Enrichment and Substance Use Disorders

This is to certify that the Capstone Project of

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Has been approved by the faculty advisor and the CE 695 – Capstone Project

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Abstract

This paper is an investigation into the possibility that Environmental Enrichment (EE) could be a protective factor for people with substance use disorders. The focus of this capstone project will be based on two main sources: “The effect of housing and gender on morphine self-administration in rats” (Alexander, B. K., Coombs, R. B., & Hadaway, P. F., 1978); and *In the Realm of Hungry Ghosts: Close Encounters with Addiction* (2010) by Gabor Maté. Alexander et. al, (1978) and Maté (2010) offer suggestions that relate to key parts of EE. The effect of housing and gender on morphine self-administration in rats (Alexander et. al, 1978) and *Hungry Ghosts* (Maté, 2010) will be reviewed for common themes. Finally I will examine how principles of the effect of housing and gender on morphine self-administration in rats (Alexander et. al, 1978) and *Hungry Ghosts* (Maté, 2010) can be applied to principles of EE to develop a usable plan for people with substance use disorders.

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Introduction

Addiction is not unique to humans, but there are protective factors against substance use disorders that are unique to humans (Flanagan, 2013). In this paper the correlations and contradictions between research with rats and research with humans are explored while focusing on protective factors. Through this investigation many potentially protective factors will be examined. Understanding Environmental Enrichment (EE) is one way to understand the relationship of these protective factors.

Different meanings of EE are emphasized when EE is applied to rats compared to when EE is applied to humans. These differences center on certain social factors. However, there are connections between both groups. Different aspects of EE will be compared in order to discover common themes. The last part of this paper explores the EE aspects of selected evidence-based programs.

Review of Literature

Substance Use Disorder

The meaning of Substance Use Disorder as described in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association [APA], 2013, p. 483) relates to four general areas: impaired control, social impairment, risky use, and pharmacological criteria. The area that may be the most relevant to EE is the “pharmacological criteria” (APA, 2013, p. 483) area. The pharmacological criteria area includes two parts, “tolerance,” and “withdrawal” (APA, 2013, p. 484). According to the APA (2013), tolerance requires an:

increased dose of the substance to achieve the desired effect or a markedly reduced effect when the usual dose is consumed. The degree to which tolerance develops varies greatly across different individuals as well as across substances and may involve a variety of central nervous system effects (p. 484).

In addition to tolerance, the pharmacological criteria area includes withdrawal: “a syndrome that occurs when blood or tissue concentrations of a substance decline in an individual who had maintained prolonged heavy use of the substance” (APA, 2013, p. 484). The APA definition mentions impaired control, social impairment, risky use, and pharmacological criteria in its definition of addiction (2013). The APA definition is fairly broad, but does not mention environment.

According to the Substance Abuse and Mental Health Services Administration (SAMHSA), “Substance use disorders occur when the recurrent use of alcohol and/or drugs causes clinically significant impairment, including health problems, disability, and failure to meet major responsibilities at work, school, or home,” (2016, Substance Use Disorders section,

para. 1). This definition includes more areas than the APA's definition. The main difference between the *DSM-5* and SAMHSA is SAMHSA's emphasis on responsibilities.

The *DSM-5* and SAMHSA emphasize different aspects of substance use disorders. The SAMHSA definition emphasizes an inability to meet major responsibilities, whereas the *DSM-5* definition emphasizes four general areas "impaired control, social impairment, risky use, and pharmacological criteria," (APA, 2013, p. 483). Neither of these definitions mentions environment, or EE.

People with substance use disorders make up about 6.4% of those people 12 or older who in 2014 reported that they drank in the past 12 months (SAMHSA's National Survey on Drug Use and Health, 2014). In the last ten years, the percentage of Americans 12 years old or older that use illicit drugs has increased from 8.3% in 2002 to 10.2% in 2014. According to the report, about 7.9 million people had both a mental disorder and a substance use disorder (SAMHSA, 2014).

Rat Park Experiments

The morphine self-administration study (Alexander, B. K., Coombs, R. B., & Hadaway, P. F. 1978) which was titled "The effect of housing and gender on morphine self-administration in rats," but which is more commonly known as the Rat Park experiments, were a series of experiments about drug dependence. This study was conducted with rats and challenged the usual notion of certain chemicals being so addictive that a person or rat would continue using that chemical after they had tried it and would not be able to stop. The study challenged the notions of tolerance and withdrawal previously mentioned. The user would be irrevocably hooked with very little time of exposure. According to SAMHSA, this is called the Introductory

phase (SAMHSA, 2013). In the Introductory phase, the person is introduced to a drug casually and does not have direct access. The person might use that drug once or twice in a month, but generally not more than twice per week. From this stage, a person may advance to the other stages. The final stages are Maintenance, Disenchantment, and Disaster (SAMHSA, 2013).

The notion that certain drugs lead directly to a physiological state involving tolerance and withdrawal is based on many studies of rats found that rats would self-administer a given addictive chemical until the rats became addicted. An example of a typical experiment conducted by Woods (1978) involved implanting mice with a needle in one of their veins, which was connected to a tube in the ceiling of a Skinner box. In this box, mice could inject themselves with a drug simply by pressing a lever. After this experiment, hundreds of similar experiments were conducted with other captive mammals with similar results.

The Rat Park experiments (Alexander et al., 1978) challenged the former notion of drug addiction by hypothesizing that the environment of the rats in the study was more important than previous research believed (Woods, 1978). The hypothesis by Bruce K. Alexander (1978) and his colleagues at Simon Fraser University in Canada was that drugs do not cause addiction; that the apparent addiction to opiate drugs commonly observed in laboratory rats exposed to them is actually attributable to their living conditions: not to any addictive property of the drug itself.

This study by Alexander et al., (1978) seems to have contradicted the views of the *DSM-5* and SAMHSA. Alexander and his associates demonstrated this by using three populations of rats. Rats were examined in the Rat Park with three different histories. There was Group CC, which was isolated in laboratory cages once their members were 22 days old. There was Group PP, which was left in Rat Park from 22 days old until the experiment ended at 80 days of age.

There was also Group CP, who was moved to Rat Park at 65 days of age from the cages. Finally, there was Group PC. Group PC was placed into Rat Park at 22 days of age, and moved into cages at 65 days of age.

Group CC and Group PC were drawn to the morphine right away, with the caged males drinking 19 times more morphine than other rats (Alexander et al., 1978). Group PP, who had been in Rat Park since weaning would try the morphine water but preferred the plain water. Group CP rejected the morphine water in its strongest concentration but as it became sweeter they drank it almost as much as the caged rats. According to Alexander, this meant that they wanted the sweet water so long as it did not disrupt their normal social behavior.

Although there could be a connection between the social aspect of a rat's life and a rat's susceptibility to addiction, there may be differences in humans and rats that are significant.

Owen Flanagan (2013) explored some of these differences in his work on shame. He said:

The brain reward system of non-human animals has interesting similarities to the human reward system, but the social ecologies of mice and humans are entirely different, as are the capacities served by culture and an enormous prefrontal cortex. A rodent cannot consciously resolve, possibly in consultation with fellow mice, to refrain from consuming a drug because its life is not going well, because it is causing communal harm. A rodent cannot relapse, and then regret and feel ashamed or guilty for its failure to maintain abstinence. (p. 4)

So far, this project has looked at a few ideas of the meanings, occurrence, and course of addiction. Additionally, some of the connections and differences between rats and humans when

they have been exposed to addictive substances were reviewed. The next section will examine some of these differences more closely.

Hungry Ghosts

Gabor Maté's book, *In the Realm of Hungry Ghosts: Close Encounters with Addiction* (2010) may provide a way to connect Alexander et al., SAMHSA, and the American Psychiatric Association. This book is about Maté's work with the East Side Vancouver Canada residents at his clinic. The author looks at his own life and surveys the relevant literature as it pertains to addiction. Through his study, he found that there are three things that may increase a person's likelihood to become involved in addiction. Maté says "Thus we might say that three factors need to coincide for substance addiction to occur: *a susceptible organism; a drug with addictive potential; and stress*" (2010, p. 147).

When reviewing this quote, it may apply to Alexander et al.,'s (1978) research on rats. The group of rats that was not exposed to life in cages (Group PP) tried the water mixed with morphine, but did not return to it. This group of rats may not have been susceptible, or under stress. The group that had lived some of the early days of their lives in a cage but then moved to Rat Park (Group CP) rejected the morphine water at it's strongest concentration, but began to drink it almost as frequently (as often, or as close to the same amount) as the caged groups (Group CC, and Group PC).

There may be a connection between EE and decreased rates of addiction. With rats, simply increasing the size of the cage, increasing the amount of rat colleagues, and increasing the amount of toys to play with greatly reduced the rates of addiction. Owen Flanagan (2013)

mentioned some unique qualities of life as humans that may be protective factors against addiction, but he is not the only one who has done research on this area.

The role of EE is well established by Kirkpatrick, Marshall, Clark, and Cain (2013). Its role in reducing recidivism is one way that EE techniques have proven helpful. Kirkpatrick et al. (2013) looked at previous research about the effects of EE on impulsivity. In their own study they examined “locomotor activity, impulsive choice, impulsive action, reward discrimination, and reward sensitivity as a function of rearing environment” (Kirkpatrick et al., 2013, p. 721), in three populations: “rats reared in isolated, standard, or enriched conditions were tested on reward contrast and reward magnitude sensitivity procedures,” (Kirkpatrick et al., 2013, p. 722). Some of these factors may also apply to humans.

Risk Factors of Substance Use

Kirkpatrick, K., Marshall, A. T., Clarke, J., & Cain, M. E. (2013) found that differences in rearing did have effects in the areas they examined. The main change that they saw had to do with “reward sensitivity” (Kirkpatrick et al., 2013, p. 712). Reward sensitivity refers to the relative importance a reward has to the subject compared to other items or activities. If we were looking at reward sensitivity in the Rat Park series of experiments, it would be a measurement of the attractiveness of the morphine water compared to normal water. Kirkpatrick et al., (2013) found that these rearing effects changed serotonergic and dopaminergic systems in the prefrontal cortex. Isolated rearing decreased the function of reward systems, which has also been shown to increase impulsive choice behavior (Ho, M.-Y., Al-Zahrani, S. S. A., Al-Rwaitea, A. S. A., Bradshaw, C. M., & Szabadi, E., 1998; Loos, M., Pattij, T., Janssen, M. C., Crounotte, D. S.,

Schoffeleers, A. N., Smit, A. B., . . . van Gaalen, M. M., 2010; Pardey, M. C., Kumar, N. N., Goodchild, A. K., & Cornish, J. L., 2012, as cited in Kirkpatrick et al., 2013, p. 722).

A similar study to Kirkpatrick et al., (2013) was conducted by Beckmann, and Bardo (2012). The phrase that is used in their study is not “impulsive choice behavior” (Kirkpatrick et al., 2013, p. 712), but “incentive salience distribution” (Beckman & Bardo, 2012, p. 331). Beckmann and Bardo seem to be studying a similar situation to Kirkpatrick et al., (2013). While the Kirkpatrick et al., (2013) study looked at the increase of activity toward the object, Beckmann and Bardo (2012) study looked at the *object* towards which the activity increased. In this study Beckman and Bardo (2012) compared the “incentive salience distribution” (p. 331) between rats reared in an enriched environment and those rats reared in a standard environment.

Beckman and Bardo (2012) attempted to measure how important their incentive was to rats that had been bred in different environments. The standard environment is isolated, without novel objects or social cohorts. The standard environment is a hanging cage. On the other hand, the enriched environment is a larger cage with social cohorts and novel objects.

In their study, Beckmann and Bardo (2012) found that EE “reduces the readiness to attribute incentive value to reward-associated cues, which may explain the enrichment-induced protection against addiction-like behaviors” (p. 331). The more enriched an environment is, the less attractive a reward will seem to the rat: the rat’s environment is rewarding enough. If a stressful environment makes rewards more attractive, then a more enriched environment decreases the attractiveness of that same reward. Stress has less power as a risk factor in an enriched environment. Stress is one of Gabor Maté’s three risk factors of substance addiction: “*a susceptible organism; a drug with addictive potential; and stress*” (2010, p. 147). Those factors

will be explored later in this paper. Next, we will look at some protective factors for substance use.

Protective Factors for Environmental Enrichment

There is disagreement on which specific protective factors constitute EE. In Kirkpatrick et al., (2013), the researchers describe EE (with rats) as consisting of three primary elements: “presence of cohorts, contact with novel objects, and amount of handling” (p. 712). In addition, the amount of EE is also important but not very well defined or agreed upon. Greenough (1976, as cited in van Praag et al., 2000), found that it was not the maximum amount of stimulation, but the optimal level of stimulation that brain development depends on. This means that while some degree of cohorts, novel objects, and handling is beneficial for functioning organisms, a higher degree of cohorts, novel objects, and handling doesn’t necessarily correspond with a higher degree of benefit or optimization.

In humans the presence of cohorts in general is also a protective, social factor. Specific social factors were investigated by Ullrich and Coid (2011). Ullrich and Coid looked at violence and recidivism among released prisoners in order to determine protective factors. They found that, “Five out of 15 hypothesized protective factors significantly reduced the likelihood of a violent reconviction. Protection was primarily related to social network factors that appeared to have long-term effects” (p. 381). An examination of those factors found that:

Four of these predictors were strongly interrelated and reflected the effects of intact and close interpersonal relationships involving positive support and engagement in activities with family or peers. It was of considerable importance that these associations were only significant once criminal family members or friends had been excluded from the network.

Close, intact interpersonal relationships are not protective when these relationships are with persons who are themselves criminals, drug abusers, or violent. (p. 386)

Relationships and activities with peers and family are other protective, social factors. Risk factors were shown to be in some ways the opposite of those factors, although some risk factors were surprising. Two factors that might initially seem to be protective were actually found to be risk factors. The two factors that were actually found to be risk factors were: “actively looked for work,” and “private accommodation” (Ullrich & Coid, 2011, p. 387). It would seem that looking for work would be protective against violence and recidivism. However, looking for work is different from having work. Ullrich and Coid (2011) hypothesized that the factor “actively looked for work” (Ullrich & Coid, 2011, p. 387) was actually a measure of frustration. They found that “a different explanation for these findings could be that ‘actively looking for work’ does not imply that the search is inevitably successful, and after some time it may lead to frustration” (Ullrich & Coid, 2011, p. 387).

The private accommodation factor may also be a risk factor. When Ullrich and Coid (2011) looked at the private accommodation factor, they hypothesized about reasons that this was a risk factor. They hypothesized that “lack of structure and social support in these accommodations,” (Ullrich & Coid, 2011, p. 387) contributed to increasing its risk. The “lack of structure” (Ullrich & Coid, 2011, p. 387) concept connects here with the “poor use of leisure/recreation time” concept found by Skeem, Winter, Kennealy, Loudon, and Tatar (2014, p. 220). Someone might not need to incorporate structure into the leisure time they enjoy, but if there isn't some structure then that leisure time may turn into relapse time.

Social factors were seen as a protective factor described by Skeem et al., (2014). In their paper they investigated the connection between recidivism and mental illness amongst offenders with mental illness (OMIs) and offenders without mental illness (non-OMIs). They found that the key factors in predicting recidivism were not mental illness, but other general risk factors. They found, “that general risk factors combine to predict OMIs’ recidivism, with criminal history and poor use of leisure/recreation time playing a role in both rearrest and RTC (Return To Custody)” (Skeem et al., 2014, p. 220).

From the research, it appears that several things can be said about EE. It has been shown that EE can be a protective factor for rats when it is involved with rearing (Kirkpatrick et al., 2013). It has also been shown that EE in humans can be a protective factor against recidivism when it is part of a treatment plan (De Vries et al., 2014). While there is not universal agreement on what EE must be, some themes have appeared. Environmental Enrichment generally includes somewhat structured social interaction, novel items or activities, and relative freedom of movement. The exact combination or magnitude of these factors is not known, but probably depends on the individual person (van Praag et al., 2000).

Examples of EE were presented that related to rats and humans, along with what seems to be helpful for people with substance use disorders. In the next part of this paper I will look at some examples of evidence-based treatment modalities approved by SAMHSA. This examination may provide a framework for implementing EE concepts into further treatment planning.

Evidence Based Programs for Substance Abuse

In Minnesota, a provider enrolled with the Department of Human Services and “licensed under state Rule 31” (Minnesota Department of Human Services, 2014, p. 16) is the Minnesota Alternatives model. It is based on the Minnesota Model. It is not listed in SAMHSA’s registry of Evidence-based Programs and Practices (SAMHSA, 2016). However, the skills and focus that the Minnesota Alternative model incorporates into its program are based on neurological research into brain plasticity and function. The central ideas of the Minnesota Alternative model relate to the 13 Key Skills: Practicing Basic Self-Care; Calming Self through Breathing and Mindfulness; Creating an Optimal Treatment; Experiencing Emotions; Building Positive Experiences; Cultivating Hope and Gratitude; Reframing; Practicing Acceptance; Understanding Impermanence; Practicing Attached Detachment; Focusing on Effectiveness; Demonstrating Understanding; and Developing Meaningful Activity (DeSanto, 2012, p. 84).

These skills work together. For example, Focusing on Effectiveness, and Demonstrating Understanding are both communication-focused skills, but communication skills can be affected by poor Practicing Basic Self-Care abilities. If someone is tired or hungry, then that person will be less able to practice Demonstrating Understanding.

The most relevant key skill to the subject of this paper is the skill of “Creating an Optimal Environment” (DeSanto, 2012, p. 92). When a client implements this skill, his or her environment has safety, connection with others, privacy, and order. When a client uses this skill, the client will “[p]ay attention to my environment and who I surround myself with. Understand boundaries” (DeSanto, 2012, p. 92). It is important to note that the skill is “Creating an *Optimal* [emphasis added] Environment,” (DeSanto, 2012, p. 92) and not creating a *perfect* environment.

The researchers hypothesize that Paula DeSanto chose “optimal” rather than “perfect,” because it relates back to the previous research discussed in this paper (Greenough, 1976, as cited by van Praag et al., 2000) that found that it wasn’t just the combination of certain common EE themes (interesting and safe environment, interaction with other humans, etc.) that was protective. The study (Greenough, 1976), as cited by van Praag et al., 2000) found that it was also the *amount* of those elements. After increasing the amount of toys or the number of other members of the community, there ceases to be a benefit after a certain point (the point of diminished returns).

Another reason to use the word optimal, rather than perfect may have to do with inter-individual differences with respect to how much interaction with other people is too much, and what amount of privacy is best. These elements of an optimal environment will depend to some degree on the particular individual. In addition, there may not be a perfect environment simply because it doesn’t exist or because a person will change and the most optimal environment for a person now may not be the same environment in six weeks. Optimal is flexible and adaptable.

Substance Disorder Treatment and Relationship to Environmental Enrichment

There are many evidence-based programs that implement themes of EE. One program is called Creating Lasting Family Connections Fatherhood Program: Family Reintegration (Strader, 2013). This program is designed to strengthen families, enhance parenting skills, and prevent further personal problems.

Overall, the focus of Creating Lasting Family Connections Fatherhood Program: Family Reintegration (CLFCFP) is similar to the focus found by other research. Strong family harmony is a large protective factor for drug use. Developing effective communication is also a goal of the

Minnesota Alternative model. Both “effective communication” and “strong family harmony” (Strader, 2013, p. 1) support EE.

If we look back to Gabor Maté’s three factors of substance addiction: “*a susceptible organism; a drug with addictive potential; and stress*” (2010, p. 147), the two factors that EE works on are a susceptible organism, and stress. An organism is susceptible to addiction after it has been exposed to an addictive drug over time. The exposure itself can change the physiology of an organism’s brain. Sobriety will change the physiology of the organism’s brain away from addiction, so that it is less susceptible than it was initially.

Environmental Enrichment also decreases the amount of stress for an individual. Individuals experience less stress when they are able to communicate effectively and use the other “Key Skills” (DeSanto, 2012, p. 84). The Minnesota Alternative model, and the CLFCFP model both have ways of decreasing an individual’s susceptibility to addiction and decreasing an individual’s stress level.

The CLFCFP model has been reviewed for effectiveness in several areas. The outcome areas measured were: Recidivism; Relationship skills, Knowledge about sexually transmitted diseases, Intention to binge drink, and Spirituality. According to the results of the study, “participants in the intervention group were 3.70 times less likely than participants in the comparison group were to recidivate (odds ratio = 0.27; $p < .01$)” (Strader, 2013, p. 3). In another study, “participants in the intervention group were 2.94 times less likely than participants in the comparison group were to recidivate (odds ratio = 0.34; $p < .05$)” (Strader, 2013, p. 3).

The Relationship skills outcome was also measured. The study found that “participants who received CLFCFP had a large improvement from pre- to posttest and then a slight

improvement from posttest to the follow-up assessment; those in the comparison group had relatively constant relationship skills from pretest to the follow-up assessment. The same pattern of results was found for all nine scales ($p < .01$ for each scale)” (Strader, 2013, p. 4).

The Knowledge about sexually transmitted diseases outcome was also measured. The participants in the intervention group “had a greater increase in knowledge about sexually transmitted diseases relative to participants in the comparison group ($p < .01$)” (Strader, 2013, p. 4). The outcome of Intention to binge drink was also measured. The results of that outcome showed that “intention to binge drink remained relatively constant for participants in the intervention group but increased for participants in the comparison group ($p < .05$)” (Strader, 2013, p. 4). Finally, the Spirituality outcome was measured. In this measure, “participants in the intervention group had an increase in spirituality, and those in the comparison group had a decrease ($p < .01$)” (Strader, 2013, p. 5). The CLFCFP and the Minnesota Alternative model focus on similar things towards their similar goal of substance use disorder prevention. The CLFCFP focuses on Recidivism; Relationship skills, Knowledge about sexually transmitted diseases, Intention to binge drink, and Spirituality. The Minnesota Alternative model focuses on the “Key Skills” (DeSanto, 2012, p. 84).

The Minnesota Alternative model has the closest concept to EE included in the Creating an Optimal Environment Key Skill. Although Creating an Optimal Environment is similar in its aim to concepts of EE, other Key Skills assist in creating or sustaining EE. The main skills are those involved with communication. Communication involves “Demonstrating Understanding,” and “Focusing on Effectiveness” (DeSanto, 2012, p. 84). “Demonstrating Understanding” (DeSanto, 2012, p. 84) is about expressing your understanding of what the other person is saying without judging them. “Focusing on Effectiveness” (DeSanto, 2012, p. 84) is about expressing

your view in a way that emphasizes your role in the situation. Instead of saying “you are annoying, stop it.” Someone who is using the “Focusing on Effectiveness” (DeSanto, 2012, p. 84) skill might say; “I am annoyed when you leave your toenail clippings on the floor, can you please stop it?” Focusing on Effectiveness and Demonstrating Understanding both strive to maintain and develop positive relationships. The skills enable someone to express that they are listening to another person. If that person is part of an optimal environment, then they are maintaining their EE.

Demonstrating Understanding is half of the communication skills pair. The other half is Focusing On Effectiveness. In a relationship it is important to listen, but it is also important to express yourself and have your needs met. With practice this can be done without yelling and screaming. When this is done, your environment is more enriched and closer to optimal.

Creating an Optimal Environment, Expressing Understanding, and Focusing on Effectiveness all help create and sustain EE, but so do some of the other skills and so do the focus areas of CLFCFP. CLFCFP focuses on Recidivism; Relationship skills, Knowledge about sexually transmitted diseases, Intention to binge drink, and Spirituality. These areas are all connected to EE.

The Emphasizing Understanding and Focusing On Effectiveness skills are similar to the CLFCFP Relationship skills. Intention to Binge Drink, is a skill that is involved with the key skills of Creating an Optimal Environment. Intention to Binge Drink and Creating an Optimal Environment both involve looking at triggers and looking at how to avoid putting someone in a position where they are likely to make a mistake. The Spirituality focus can also be examined through an EE perspective. For rats, it may be enough to have new toys to play with every other

week. For humans, we are more likely to do something if we can connect to the meaning of it. If the meaning is difficult to connect to, we can use the “Reframing” (DeSanto, 2012, p. 84) skill to turn setbacks into learning opportunities and struggles into chances to improve ourselves.

Environmental Enrichment Example

The work of Owen Flanagan (2013) touches on several things that connect with what EE is about and how EE might apply to people who have a substance use disorder. In a human social network, it would be possible to talk with fellow humans and decide that life with the chemical had become unlivable. In a human social network it might be possible to learn about how use is causing communal harm. These are two ways that EE can combat substance use disorders.

One example of this distinction is a popular part of the treatment plans at Vinland National Center. It is not unusual for a counselor or case manager to assign a few letter-writing assignments. The therapeutic effect of writing has been found to contribute to significant drops in physician visits, increased t-helper cell growth, as well as changes in autonomic and muscular activity (Pennbaker, 1997). In one example of this assignment, clients are asked to write a letter to their addiction. The letter is intended to be a break-up letter similar to what someone might write to a significant other after deciding to break up. Honesty is the most important part of this letter, meaning that the writer should include the good parts of the relationship, and the pleasant things that the writer got from the addiction as well as the negative and catastrophic things. Another common letter would be to write to your past self who was on the verge of addiction. This time the writer would talk to his or her past self and try to console them, warn them, or give them advice. Writing letters are example of treatment plan ideas that do not have a rat correlates. Although rats and humans share many qualities that mean we can both benefit from EE, it is

unlikely that a rat has feelings of regret, guilt, and shame. Although those feelings may be unique to humans, it is those feelings as well as the positive feelings felt as part of a social network that are why humans can benefit the most from EE.

Discussion

In this paper EE and substance use disorders were explored. Substance abuse disorders have to do with dependency and behavioral symptoms. These symptoms were examined. Protective factors were also examined. These protective factors share qualities that are related to the concept of EE. Environmental Enrichment has been effective as protective factor to substance use disorder behavior.

Protective factors related to EE were examined. Environmental Enrichment factors between humans and rats were compared. Several important distinctions were made between what an EE factor is for a rat and for a human. The concept of EE was compared to Gabor Maté's three factors of substance addiction: "*a susceptible organism; a drug with addictive potential; and stress*" (2010, p. 147).

Finally, EE was examined in the constitution of several evidence-based programs. The parts that were related to EE were described, and the possibility of those programs being successful was examined.

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