Fostering Character Education with Games and Interactive Story Generation

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ABSTRACT

Promoting ethical, responsible, and caring behavior in young people is a perennial aim of education. Schools are invited to include moral teaching in every possible curriculum. Efforts have been made to find non-traditional ways of teaching such as games or role play or engaging students in moral dilemmas. However, classroom environments need to consider time constraints, curriculum standards, and differing children's personalities. Computer systems can offer rich environments that detect and respond to student knowledge gaps, misconceptions, and variable affective states. This chapter presents *AEINS*, an adaptive narrative-based educational game that helps the teaching of basic ethical virtues to young children to promote character education. The central goal is to engage students in a dynamic narrative environment and to involve them in different moral dilemmas (teaching moments) that use the Socratic Method as the predominant pedagogy. We argue that *AEINS* incorporates appropriate game design principles and successfully manages the interaction between the narrative level and the tutoring level to maximize student learning. Moreover, it is able to convey the moral skills to its users, as shown in the evaluation.

KEYWORDS

serious games, interactive narrative, intelligent tutoring, student modeling, character education

INTRODUCTION

"A moral is a message conveyed or a lesson to be learned from a story or event." (Dianne, 2001)

Mounting discipline problems, sometimes resulting in violence, shoplifting, drug abuse, and other criminal behaviors, raise the need to develop an awareness of social and moral responsibilities, a core component of character education. Character education implies the widely-shared, pivotally important, core ethical values, such as trustworthiness, caring, honesty, fairness, responsibility and respect for self and others along with supportive performance values that form the basis of good character, such as diligence, a strong work ethic, and perseverance (Lickona et al., 2007).

The core ethical values are the basic principles that we consider when making decisions and judgments in our lives. Generally, character education aims to promote ethical, responsible, and caring young people. These values (virtues) are defined in terms of behaviors that can be observed in the life of the school.

One big challenge in character education area is that *knowing* what is right does not guarantee *doing* what is right. As Watson (2003) illustrated: "getting high scores in an ethical course does not guarantee at all the actual behavior of that student." And more importantly, he added that the core issue lies in not only knowing what is right and good but also in building a love for the good and the worthwhile. Accordingly, and based on Watson's view, we should: "identify what is good and what is bad behavior, instruct people as to what these are, and inspire people to behave in the right ways using examples for them to imitate." We argue that the development of moral virtues requires extensive practice in the same way as other skills such as reading or writing. Children need to practice enough independent thinking and develop their moral reasoning by being in different situations and to act according to their beliefs. By presenting the effects of their actions on themselves and others as consequences, they can, eventually, begin to formulate their own conceptions of rights, values and principles.

Schools are trying to include moral teaching in every possible facet of school, such as core subjects (academic curriculum), sports teams and clubs (extracurricular programs), and more implicitly in the teacher-student relationship (hidden curriculum) (Lickona et al., 2007). In the classroom environment, Halverson (2004) had found that traditional teaching using terms and abstractions may not be the best way to help children connect to Image s or situations in their embodied experiences in the world. Therefore, efforts to develop moral reasoning skills are made by targeting elementary and middle school students through classroom activities such as role playing, which helps students to transfer their knowledge and beliefs into actions (McBrien & Brandt, 1997), brainstorming moral dilemmas (Bolton, 1999) and using interactive learning models (Shapiro, 1999). Such efforts aim to help students' cognitive development by allowing students to pursue moral actions and see how their decisions affect other people and themselves in relation to others. These trials have shown promising results demonstrating the effectiveness of learning by doing which helps students to draw analogies between what they experience in the classroom and that of real life, that is, to see the bigger picture. However, children differ in personalities and consequently in their strengths, weaknesses and needs, which raises the need for adaptive learning. Within the classroom environment this is very difficult to address because of time and curriculum constraints (Eiriksson, 1997). Halverson (2004) challenged teachers to provide the kind of teaching that creates a safe place for their students, allows them to move outside of their comfort level and also challenges them to think outside of their current level of experience. While it is challenging to create such an environment in classrooms, computers can act as a solution.

This chapter presents *AEINS*, Adaptive Educational Interactive Narrative System, a game environment inhabited with non-playing characters (NPCs), which aims to foster character education by allowing the student to practice various moral virtues through interacting with different moral dilemmas. Moral virtues are ethical values, such as trustworthiness, wisdom, courage, chastity and justice. Throughout the game, students can get involved in various moral dilemmas (teaching moments) that focus on virtues and provide moral exemplars. *AEINS* aims to involve the students in independent thinking processes, such as self-reflection and continuous self assessment. In addition, it promotes the acquisition of skills and knowledge through interactions in an authentic environment, as has been shown from the evaluation. This can mainly occur when

the student is faced with unexpected reaction from the non-playing characters. In this case, he starts to think about the causes and effects and assesses the previous actions that lead to the current situation.

.The main idea of the *AEINS* design is centered on the integration of two pieces, first, interactive narrative techniques that engage the student in a story where he is able to act and affect how the story unfolds. The generated narrative can be interleaved by structured moral dilemmas that use the Socratic Method as the teaching pedagogy. Secondly, an intelligent tutoring technique that monitors, guides and evaluates the student's actions to provide a personalized learning process based on an existing student model.

The chapter begins with a background section that introduces the various methods and techniques used in this work, in addition to the learning theories that inspired the architecture. Next, we discuss issues, controversies and problems in previous work, followed by our work as a suggested solution. The chapter ends with results from *AEINS* evaluation.

BACKGROUND

"*Stories are connections to the past and yet carry us into the future; they speak of relationships, of human connections, and to what gives quality to our lives."(Simpson, 1998)*

In the last decade, there has been a significant growth in integrating narrative in education (Riedl & Stern, 2006; Thomas & Young, 2007; Vilhjalmsson et al., 2007; McQuiggan et al., 2008; Mckenzie& McCalla, 2009). Interactive narrative brings students through a deep story experience, and has proven to be successful in creating enriching experiences for its users, sparking problem-solving skills and individual and group decision-making skills (Bayon et al., 2003). More challenging is the combining of interactive narrative techniques with intelligent tutoring capabilities. In existing educational games, different techniques have been used such as story planning, graph structured plans, plots, and intelligent tutoring to achieve a platform that personalizes the learning experience and develops the student's knowledge and/or skills in a motivating, engaging environment.

Story planning has been used in the Mimesis educational game (Thomas & Young, 2007) and the *IN-TALE* game (Riedl & Stern, 2006) where the learning tasks are represented in interactive narrative plans. In these systems the student's freedom is high and their actions affect how the story unfolds. Other games use a scripted approach to achieve greater control of the student's experiences, such as *StoryTeller* (Mott et al., 1999) and *ELECT BILAT* (Lane et al., 2007) or use separate subsequent plots or scenes as their teaching moments, such as *FearNot!* (Bayon et al. 2003, Aylett et al. 2007a), *ISAT* (Magerko, 2006) and *Conundrum* (Mckenzie& McCalla, 2009).

In addition to interactive narrative, another important aspect in educational games is the tutoring aspect that aims to supply the educational process. Intelligent tutoring should possess one or more of the following: tutorial planning, student models, learning objectives, domain and pedagogical models. Despite the importance of each of these components, the student model is considered the key element in the adaptation process (Brusilovsky, 1994; Abraham & Yacef, 2002). It assists in providing a personalized learning process based on the student's strengths, his weaknesses and his needs. The *TLCTS* educational game (Vilhjalmsson et al., 2007) has a student model in its environment that is updated only based on the student's explicit actions and does not consider the student's intentions. *TLTS* (Johnson et al., 2004) is an interactive educational game that uses a

student model to provide an adaptive learning process and simulates dialogues. However it does not take full advantage of the storytelling potential of games seen in interactive drama applications (Magerko et al., 2006). Other educational games that have been developed without considering the presence of a student model are: *TIME* (Harless, 1986), *TEATRIX* (Prada et al., 2000), *BAT ILE* (Waraich, 2004) and *Crystal Island* (Mott & Lester, 2006; McQuiggan et al., 2008).

As seen from the above review, educational games exhibit the presence of four features shown to individually increase effectiveness of educational games environments, yet not integrated together. These are: the presence of a student model; a dynamic generated narrative approach that aims to provide the student with high agency within the environment and generates a story according to the student's preferences; the use of scripted narrative that constrains the student agency at certain parts that supply education in order to allow tracking of the student's actions and assessment of them; and the presence of a continuous story that engages the user and allows the presence of believable, evolving non-player characters that support the educational process. To the best of our knowledge, no educational game has integrated these features in a single architecture before and this is the contribution of this work.

THE VISION

"To educate a person in mind and not in morals is to educate a menace to society."
President Theodore Roosevelt.

Until this point, challenges in character education and the idea of using educational games to aid the education of character has been mentioned. The contribution in integrating individual components currently used in various educational games has been also justified. This section provides an overview of the ideas, learning theories and techniques that inspired the development of our educational game.

As the intention is to design and implement an educational game, both educational theories and game aspects should be considered. Educational theories such as Keller's ARCS model (Keller, 1987) and Gagné's nine events (Gagné et al., 2005) can help in designing the interface and the educational objects as part of the educational game world. Gee's game aspects can act as a benchmark in evaluating the game aspects in the developed educational game (Gee, 2004).

As mentioned earlier in this chapter, learning through practicing is one asset of an educational games environment. The environment can be enriched with interactive moral dilemmas (teaching moments), where the student can act and see the effect of their actions on themselves and others and the presence of evolving agents that can act as an emotional engaging hook. It can be seen that students of all ages use questions in their learning of topics; questions act as transition means between the observation and hypothesis stages. Discussions and involvement in moral dilemmas offer inspiring examples after which students can model their own behavior. They also provide authentic contexts that are considered an adequate framework to promote argumentation (Meacham & Emont, 1989). The Socratic Method is one way of using questions in order to develop moral thinking and provides opportunities for personal discovery through problem solving.

In classroom environments, the Socratic Method (Socratic Dialogue) is dramatic and entertaining. It triggers lively classroom discussion and helps students make choices based on what is 'right'

instead of what they can get away with. The evaluation of *AEINS* reflects the fact that most of the participants (around 86%) succeeded in recognizing what could be the 'right' thing to do after being involved in the Socratic Dialogue. According to this model, the teacher asks a series of questions that leads the students to examine the validity of an opinion or belief. This is a powerful teaching method because it actively engages the student and encourages critical thinking, which is just what is needed in examining ethics, values, and other character issues. It allows an appropriate amount of choice during ill-structured and authentic investigations that lead to the development of inquiry skills (Avner et al., 1980). In Lynch et al. (2008), it has been shown that even in domains where it is impossible to make sharp distinctions between good and bad solutions due to the lack of ideal solutions or a domain theory, solution differences are meaningful. In our opinion, the students' different answers to a Socratic Dialogue are also meaningful and reflect their own beliefs and thoughts. The Socratic Method has been applied previously in the intelligent tutoring system, CIRCISM-TUTOR that teaches how the cardiovascular reflex system stabilizes blood pressure functions (Kim et al., 1989; Yang et al. 2000). It has been shown that applying the Socratic Method positively influences the learning process..

An important aspect of moral dilemmas is that the ethical argument as a whole is ill-structured and it is hard to define the set of right answers or actions. Simon (1973) in his explanation of the architect's design process provides some insight about how to deal with these kinds of problems: "During any given short period of time, the architect will find himself working on a problem which, perhaps beginning in an ill structured state, soon converts itself through evocation from memory into a well structured problem. "In other words, a problem that is ill-structured in the large can be well structured in the small. We therefore decided to make use of pre-analyzed moral dilemmas in a way that every analyzed part can act as a separate well-defined problem on its own. Moral dilemmas such as Kohlberg's moral dilemmas (Kohlberg, 1984) and other dilemmas designed specifically for school children can be used to construct so-called teaching moments. These dilemmas allow students to pursue different procedures for solving problems based on their perceptions and interpretations of the nature of the problem.

Every teaching moment can be imagined as non-interactive story presentations interleaved with user-decision points that allow the story to progress forward, see Image 1. The teaching moments' representation allows them to become part of the main story as they have narrative prerequisites that allow its incorporation in the dynamic generated narrative and allows the use of an intelligent tutor system (ITS) that monitors the student and is able to evaluate his actions. The tutor aims to provide a student model that allows adaptive learning to occur. The purpose of the Student Model is to help students learn about moral situations and ethical actions by maintaining an accurate model of a student's current knowledge state which allows more intelligent and adaptive pedagogical decisions and actions to occur. The student's current knowledge state is expressed by the student profile within a rule-based representation. By the end of the whole experience, the student will have experienced some emotional and moral complexities. According to Freeman (2004), this kind of experience, especially when these complexities develop over the course of a game-like environment, can leave the player with a better and deeper understanding.

Image 1. A graph representation of a teaching moment. (Adapted from Silva et al., 2003)

The presentation of the teaching moments should occur not as separate events, but as part of a continuous story. A planner should generate an interactive story that allows the student to act and affect how the story unfolds and at the same time targets to satisfy the goals (teaching moment

preconditions). In this way, the story is generated for the sake of the educational targets and still preserves the dramatic pedagogy of interactive narrative. The continuous story allows the presence of agents that inhabit the story world and can participate in supplying the learning. The agents should be semiautonomous where this allows the story generator to dictate to them what to do at times when required. Autonomous agents can result in executing actions that can interfere with the educational aims. The agents characters should evolve as the story unfolds, for example, an agent who is a friend to the student can be an enemy based on certain actions of the student. If the teaching moment to be presented requires the presence of an enemy, this agent will be chosen for this role. We argue this should increase the believability of the environment. Having the agents as the student's friends offers a known environment to the student that facilitates the interaction and the virtual illusion.

For the purpose of evaluation, *AEINS* should be intrinsically evaluated to make sure that the design goals have been met, the levels of educational outcome can be measured according to Bloom's Taxonomy and an empirical evaluation should take place.

In the next section, we will present the educational game, *AEINS*, which aims to address the shortcomings encountered in the currently existed systems illustrated previously in the Background Section.

AEINS (ADAPTIVE EDUCATIONAL INTERACTIVE NARRATIVE SYSTEM)

The main idea of the proposed work is the integration of interactive narrative, evolving characters, and intelligent tutoring in a single architecture of an educational game called `*AEINS*' in order to deliver basic moral virtues to young students. The ultimate advantage of *AEINS* lies in its ability to interact with every single student on a different basis according to the student model particularly built for that student. Before getting into the details of each module, it is worth to give the reader a general idea about how *AEINS* works. A model of the game can be seen in Image 2.

Image 2. AEINS' Working Model

The Image shows that the game starts by presenting the game world to the student. At the first two stages, the game gives a brief introduction about the world and allows the student to choose friends (each has different moral virtues) to initialize the student model. Then at the third stage, the pedagogical model chooses the next teaching moment (educational object) to present. At the fourth stage, the game generates the appropriate narrative that aims to achieve some narrative goals, the narrative preconditions of the teaching moments. In this stage, the student is free to act and sometimes their actions can violate the generated plan, at which point the story generator has to alter the plan to accommodate the student's actions. Once the preconditions are satisfied, the teaching moment starts and the student interacts with it. In the sixth stage, the pedagogical model is tracing the student's action(s) and updates the student model accordingly. After finishing the teaching moment and based upon the current updated student model, the cycle continues as shown in Image 2.

In the following subsections, we will introduce the architecture of *AEINS* and the representations of the various modules of *AEINS*.

The Architecture of *AEINS*

The *AIENS'* architecture is the main contribution of this work where it attempts to address the shortcomings of the existing systems. The architecture has been designed in a way that allows the generation of interactive narrative at run time. Such a design addresses the issue of tracking the student learning versus student's agency. In *AEINS*, agency is constrained when interacting with the teaching moments to preserve the educational targets. After finishing the teaching moment, the student resumes his high agency. This tactic is very similar to games design where the player has many choices in the environment and, based upon a certain choice, he will be led to a specific path and then back to the main story after finishing the desired task.

Image 3. AEINS' Architecture

The architecture consists of six models: four modules to serve the educational targets and two models for generating the story and storing information about the story world as shown in Image 3. The following subsections introduce the *AEINS* working model and how the various architecture components are represented and utilized. In the next subsection, we will introduce the domain model and its representation.

Domain Model

The domain model was designed with the help of an educational expert. The model describes the various concepts (i.e. values) in the ethics domain and their relationships. One part of the model defines the principles of character education (Elkind & Sweet, 1997) and represents their relationships and dependencies. A frame-based representation has been used to demonstrate those relationships and dependencies as shown in Image 4. Some values are considered main values such as *be honest*; this value composes of sub-values such as *do not lie*, *do not cheat* and *do not steal*. For the main value to be considered mastered, each of the sub-values has to be mastered. The other part of the domain model is a repertoire of moral dilemmas (teaching moments). Each sub-value is mapped to one or more teaching moment as visualized in Image 5. The sub-values are the main focus of their corresponding teaching moments.

Image 4. Part of the character education domain representation

Image 5. Relation between principles and teaching moments

Teaching Moments

Keller (1987), in his paper, defined Attention, one condition of curiosity, as "capturing the interest of students and stimulating the motivation to learn". Teaching moments in *AEINS* are provided in a familiar context, for example, if the student fails to show that his beliefs towards a certain misconception (immoral value) have been not mastered yet then the next teaching moment will focus on the same immoral value. It has been shown that by providing a familiar context, students are able to better activate their prior knowledge (Anderson et al., 1977). When needed, during the interaction with a teaching moment, some questions are worded from the perspective of the student to facilitate the activation of prior knowledge (Anderson & Pichert 1978).

The story in *AEINS* is generated around the teaching moments. The teaching moments, as illustrated previously, are graph structured plans (see Image 6). They allow the use of an intelligent tutor to track the student's actions and assess them in the form of a step-by-step follow-up. Ideally, each teaching moment path describes an inquiry-based narrative, a story in which the protagonist is the user in the role of making moral decisions. The teaching moments allow students to pursue different procedures for solving the problem based on the student's perception and interpretation of the nature of the problem. The student's understanding gained through this process is situated in their experience and can best be evaluated in terms relevant to this experience.

The Socratic Method is used as the teaching pedagogy woven into the narrative in order to reinforce positive actions. The Socratic Method is capable to force the student to face the contradictions present in any course of action that is not based on principles of justice or fairness. The voice of Socrates comes from the moral agent participating in the current teaching moment. When the student performs an incorrect choice, a text dialogue starts between the moral agent and the student that tries to emphasize the undesirable beliefs and encourage good actions. The dialogue continues until the story ends with either a negative or positive reward based on the computation model of the student's actions.

The pedagogical model runs the educational process effectively without interfering as a tutor; everything was blended together in the narrative experience: even feedback is tailored for the story context.

Image 6. Example of a teaching moment

Although the different branches of every teaching moment are pre-defined, each teaching moment exhibits variability through allowing different characters and places to present the teaching moment depending on the story-world state. Each teaching moment represents a part of the whole story and focuses on teaching a specific concept (i.e., value) so that the concept mastery is established. Each teaching moment has certain prerequisites that must be fulfilled before the execution of the teaching moment takes place. Manipulating a teaching moment's priority is done via the represented rules as follows:

Trigger: teaching moment TM_1 has not been presented
and teaching moment TM_2 has not been presented
and value "*do not cheat"* is not held by the user
and value "*do not lie"* is held by the user
Action: set priority to teaching moment TM_2

The representation denotes that if (a) a specific pattern of teaching moments (TM_1 and TM_2) has not been presented to the student yet and (b) the student holds certain values (*do not cheat*) and does not hold others (*do not lie*), the action part of the rule executes (teaching moment TM_2 has priority over teaching moment TM_1). If several rules satisfy their premises, this results in having more than one teaching moment to present and any of them is suitable to be presented, next, to the student. In this case, one of these teaching moments is chosen randomly.

This section described the domain model and gave an example for the design of the graph structured teaching moments. In the next subsection, we will introduce the pedagogical model and its role in providing adaptation.

Pedagogical Model

The pedagogical model aims to adapt instruction by monitoring and evaluating the student's actions. The model is developed in the form of production rules. These rules are used to give the system specific cognitive operations to reason about the student and the teaching process. With ill-defined problems, development is a change in the way a person thinks and not merely a case of acquiring more knowledge. The idea is based on analyzing moral dilemmas and transforming them to a story graph structure, specifying the decision points that reflect the specified skills, and deciding what actions should be taken by the student in order to reflect these skills. The model specifies how a student would ideally use the system and how the system should assess the student's skills and update the student model accordingly. An example for a skill evaluation rule is as follows:

IF action ("student", "TM_1", "agreed to lie")
and IF action ("student", "TM_1", "insists to lie")
and IF action ("student", "TM_1", "lied for friend's sake")
and IF action ("student", "TM_1", "finally agrees that lying is bad")
THEN skill ("student", "do not lie", "acquired", 0.6)

The premises in the above rule are part of the student model constructed for each individual student. They represent the meaning of the actions taken by the student. The above rule evaluates the student actions in teaching moment TM_1 and assigns a confidence factor to the attempted skill. The confidence factor (CF) is a number between -1 and 1 indicating the strength of the belief in that fact. A CF of value equal to '1' represents total certainty of the truth of the fact, while a CF of value '- 1' represents certainty regarding the negation of the fact.

This section described how the pedagogical model's cognitive operations have been represented using the rules representation. In the next subsection we will introduce the main component that helps the pedagogical model to provide adaptation that is the student model.

Student Model

Student modeling aims to provide a personalized learning process based on the current student's skills. The student model in *AEINS* is currently a quite complex form of the overlay model represented in the form of rules, associated with certainty confidence, to allow access to sufficient data to permit reliable inferences about the student's beliefs. This can be solved using default assumptions which may later have to be withdrawn, or by initializing the student model through some preliminary actions that are designed specifically to help infer an initial model of the student as in *AEINS*. The model assumes that the student knowledge is a subset of the expert's knowledge. The model aims to expand the student knowledge until it matches the expert's. *AEINS* builds a model of the student's learning process by observing, analyzing, and recording the student's actions and choices from the generally accepted ethical views. Given the following representation, a model has been developed that infers the character stereotype:

IF skill ("student", "do not lie", "acquired", CF_1)
and IF skill ("student", "do not cheat", "acquired", CF_2)
and IF skill ("student", "responsible", "acquired", CF_3)

THEN concept-learned (“student”, “honest”, “held”, Z)

We are following the method used to calculate the confidence factor as that used in the Mycin system (Shortliffe, 1981). The above representation denotes that if the student acquires the skills *do not lie*, *do not cheat*, *do not steal*, and *responsible* with confidence factors CF_1, CF_2, CF_3 respectively (CF_i values are obtained by the pedagogical model), then the rule confidence factor can be determined using the combination function. The rule confidence (Z) for the conjunctive premises is calculated using the following combination function: Z=min (CF_1, CF_2, CF_3)

The student model is an essential component in providing adaptation. This section presented the student model and a rule example for the student model representation. In the next section, we will introduce the story world of *AEINS*.

Story World

The world model contains all the information about the non-playing characters and the objects, such as their description, location, and their state in the game world. The story world consists mainly of the current world state, and its role is to track and save all the current actions of the student and the agents to be used later by the planner. The current world state is updated after every executed action either performed by the student or by one of the agents. The main advantage of having more than one non-playing character is the freedom to portray agents who do not share the student’s goals, who can then be used to provide negative examples (Thomas & Young, 2007). On the other hand, they can also act according to the moral goals and can give positive examples or help the student to stay on the right track. The story is in effect a narrative describing the story world, the characters’ actions, the actions the student is taking and the effect of these actions on the story world.

The presence of non-playing evolving characters helps in providing realism and believability to the environment and in supplying education to the student especially as a user of the Socratic Method.

The story world houses the information about the non-playing characters and the objects. It also stores information about the current world state. In the next section, we will show how the story is generated in *AEINS* and how the non-playing characters can have direct reactions to the player student’s ones.

Story Generation in *AEINS*

According to Riedl and Young (2006), planning is efficient and able to generate different narratives for different users; it can also generate different narratives for the single user on subsequent play turns. This technique enhances the user's sense of control in the narrative environment. The main story in *AEINS* is generated using a STRIPS-like planning algorithm, similar to the work of Barber and Kudenko (2007).

In a STRIPS-like representation planning algorithm, actions are instances of generic schemata called operators. An operator has preconditions and effects. The preconditions indicate the conditions that must be valid for the operator to be applicable. The effects indicate how the current situation changes as a result of applying the operator. Given a narrative goal (i.e., the preconditions of the next teaching moment) and the current world state, the story engine selects a

story action to execute from the produced plan. The following table shows an example of two action operators represented with variable argument(s) for which different instances can be substituted. Currently for every possible way the student can violate the story plan, an alternative story plan is generated. However, alternative approaches need to be considered when scaling up the system to a very large story world.

Action Name	Preconditions	Effects
move (Agent, $Place_1$, $Place_2$)	char(Agent) & place ($Place_1$) & char_at (Agent, $Place_1$)	char_at (Agent, $Place_2$)
be_friend_to ($Agent_1$, $Agent_2$)	char($Agent_1$) & char ($Agent_2$) & like ($Agent_1$, $Agent_2$)	friend ($Agent_1$, $Agent_2$)

As purely behavioral systems could not offer any guarantee that desired outcomes would be reached, combining planning with reactive execution can be seen as a solution (Aylett et al., 2007b). The agent reactive action towards the student aims to provide a direct reaction to the last student's action instead of only basing the action choice on the whole past history of the narrative. Imagine the following situation, the planner picks 'be_friend_to' and 'move' actions to be executed. Luckily, the student follows the plan and chooses to 'be_friend' to one of the agents. In normal planning this will lead to the execution of the move action automatically. By the reactive planner, we aim to respond to the `be_friend' action taken by the student before continuing to execute the original plan. We argue that this increases the believability of the agents' reactions.

The reactive planning selects an action to be executed from a set of pre-authored actions based on the associated value 'N', which is the suitability cost. The N value changes dynamically during run-time based on the student's actions. For example, if the student asked one of the agents to be his friend, the N value of 'reply_to_friendship' action will dominate the N value of 'respond_to_play' action according to a pre-defined relation matrix. The following table shows an example of two action operators for the reactive planner.

Action Name	Preconditions	Effects
reply_to_friendship(Agent, student, N_1)	like(Agent, student)	agree_to_be_friend & friend(Agent, student)
respond_to_play(Agent, student, N_2)	not(current_TM(TM_2)) & friend(Agent, student)	accept_play_invitation

After responding to the student's action, the STRIPS planner continues executing the previously generated plan, so for the above example the 'move' action will be executed. An example of a generated narrative is shown in Image 7.

Image 7: Example of the generated plan

The first row represents the current story world and the last row represents the goals to be satisfied. The left column shows the first plan the story generator produces, the actions in italic are assumed student's actions. If the student's action does not satisfy the first plan, another plan is developed; the second plan in the middle column. Again if the student's action violates the plan, a third plan is developed; the plan in the right most column. This continues until the goals (teaching moment narrative preconditions) are satisfied. A full example run is attached as appendix.

As can be seen the story generation in *AEINS* is the learning medium that constitutes not only characters and objects participating in the generated story, but also it incorporates the learning objects wherein the evolving agents have a recognized pedagogical role. In the next section, we will introduce the presentation model and how it makes use of Keller's ARCS model.

Presentation Model

The presentation model handles the flow of information and monitors the interactions between the user and the system. Keller's ARCS model provides four classes (Keller, 1987): **Attention**, **Relevance**, **Confidence/Challenge**, and **Satisfaction/Success** that has been considered while designing the educational game interface. This model mainly aims to gain and retain the student's attention and to understand implicitly how the activities relate to their current situations. In addition to making use of surprise through the presence of unexpected problems or new situations, which helps to capture the students' attention (Mergel, 1998). At the awaken stage, the interface itself is designed in a way that captures the student's attention. The playing characters' personalities evolve over time, which make their reactions different every time with respect to their current personality. The variance of the narrative experience itself is engaging and helps to capture the attention of the student and create new experiences. At the explain stage, feedback and explanations are given to the student. This helps the student reflect on her own actions and their consequences. At the Reinforce and Transfer stages, the student has the freedom to see all the previous history of her actions and other playing characters' actions. The student is involved in the moral dilemmas and the consequences depending on her choices and actions. This forces the student to make a conscious choice in terms of ethics.

To interact with the story, a play screen is offered as shown in Image 8 where the student is able to choose an action; actions include move, invite, persuade, etc. The student is then able to click on one of the characters and places pictures in the world. For example, the student can choose the *invite* action and then clicks on *Ziad's* and the *house's* pictures. The end result will be "*invite Ziad to my house.*" Ziad has the freedom to accept or reject the user's invitation according to a specific set of rules and constraints that determine the actions that the non player-characters can take.

Image 8. A screenshot for the Play window

The student is engaged in a text-based conversation that evolves depending on the student's actions. The aim is to enable students to test their own intuitions and thoughts about certain moral values and experiments. In so doing, it is believed that students will better understand the nuances of the domain. In addition, the system presents the student with good models and examples, after which they, hopefully, will model their own behavior. *AEINS* allows the whole unfolding story to be recorded at run-time to allow the student to re-visit any part of it whenever he likes. This gives the student the chance for self-reflection and could lead him to re-evaluate the situation from a new perspective. This kind of situated learning helps the student learn not just the actions that are required, but also the perceptual conditions in which they apply.

The presentation model acts as the interaction window between the student and *AEINS* as it handles the flow of information in both directions. In the next section, we will elaborate on the educational theories that helped to shape this research.

EDUCATIONAL THEORIES

The importance of incorporating learning theories in the design of educational games has been discussed in previous sections. We talked about the three theories that appear to be most closely aligning with the generally accepted game design principles: Keller's ARCS Motivational Model, Gagné's Events of Instruction, and Bloom's Taxonomy. A failure to base serious game design on such well-established and practical instructional theories increases the risk of the game failing to meet its intended educational goals, yielding a participant who is entertained but has not acquired new skills or knowledge (Gunter et al., 2006). In *AEINS*, the three principles Gagné considered essential for successful instruction have been considered as follows:

- Providing instruction on the set of component tasks that build toward a final task: This principle is tackled in designing the teaching moments, where coaching is realized using the Socratic Method and by providing personalized feedback. Such teaching strategy contributes in the building of skills required to master the task.

- Ensuring that each component task is mastered: This principle has been attempted in *AEINS* using the pedagogical model that tracks the student's learning process and evaluate his moves. Accordingly if the component is still not mastered, the model chooses another educational object that attempts to address the misconceptions the student has.

- Sequencing the component tasks to ensure optimal transfer to the final task: This principle has been applied by representing the domain model in the form of hierarchal frames. The frames representation allows the sequencing of concepts in an order that allows the student to build relationships between the concepts and their dependency, leading to an understanding of the final task.

Bloom's taxonomy was determined to develop a practical means for classifying curriculum goals and learning objectives. This is divided into six levels; knowledge, comprehension, application, analysis, synthesis, and evaluation. We argue that *AEINS* is capable of addressing the higher levels of Bloom's taxonomy. Through being involved and interacting in moral situations (teaching moments), the student is able to see the moral values (concepts) involved in the situation context, and the pattern they are framing of the situation. Accordingly, he is able to aggregate parts together, evaluate the situation and make judgments about the value of ideas. Based on the idea pictured, he can act to solve the problem encountered. These skills are part of the higher levels; analysis, evaluation and synthesis. Bloom's taxonomy has been used as an evaluation tool for the *AEINS'* educational outcome.

The last learning theory inspiring this work is Keller's ARCS model, which relies on four foundational categories that are to be applied when designing instructional activities. ARCS is an acronym that represents four classes: Attention, Relevance, Confidence/Challenge, and Satisfaction/Success. The details of how each has been applied are as follows:

- **Attention**: This aspect relates to gaining and keeping the student's attention. aims to capture the student's attention by using a graphical user interface and inquiry arousal through enabling the student to affect how the story unfolds.

- **Relevance**: Simply put, students need to be able to understand implicitly how the activity relates to their current situation, and/or to them personally. *AEINS* tackles this attribute by designing and implementing teaching moments that contextually discuss situations the student is familiar with or where there is high probability the student will face one.

- **Confidence/Challenge**: This fundamentally paves the way for students to feel that it is worthwhile to put effort into participating in the activity. If students believe they are, somehow, incapable of achieving the objectives or that they will be wasting their time because it will take too long, or, conversely, that the challenge is beneath them, their motivation will most assuredly decrease. *AEINS* uses various teaching moments that tackle different student knowledge levels to attempt this property.

- **Satisfaction/Success**: Students must attain some type of satisfaction or reward from the learning experience. *AEINS* provides positive and negative rewards as part of its teaching pedagogy. These rewards take the form of formative and summative feedback that is part of the teaching strategy within the teaching moments.

AEINS also considers other educational theories in its design and implementation, for example research suggested that students benefit from being encouraged to consider a collection of evidence and coordinate their theoretical ideas with supporting or contradictory evidence as they engage in argumentation (Koslowski, 1996; Bell & Linn, 2000). In addition, researchers suggest that students must have opportunities to choose among different options and to reason which criteria lead to the option chosen (Kuhn, 1993). *AEINS* follows these approaches and uses the Socratic Method as it has been shown to be a highly effective approach (Elkind & Sweet, 1997) in helping children become ethical, respectful, responsible people.

AEINS uses misconception in favor of the learning process, where it has been shown that when students faced with evidence that they believe to be true is, in fact, false and a misconception, they are often interested in resolving the discrepancy (Bergin, 1999). *AEINS* also words the question from the perspective of the student to provide a meaningful context and facilitate the activation of prior knowledge; this technique has shown its usefulness in the learning process as demonstrated by Anderson & Pichert (1978). For example, if we would like students to investigate the effects of stealing, we could pose the problem of shoplifting and the case when they are the owners themselves.

AEINS uses the Socratic Method as its main teaching pedagogy. The Socratic Method has been easily woven into the teaching moments' story lines. It displays its strengths when the students make a bad choice. Through discussion, students should then be forced to face the contradictions present in any course of action not based on principles of justice or fairness. This method requires a delicate balance between letting the students make decisions, and demonstrating the limits in their reasoning. Finally, "raising the ante", which is defined as raising the stakes and introducing consequences, is a tactic followed if a student sticks with the unethical choice. For example, if we would like students to investigate the effects of stealing, we could pose the problem of shoplifting and ask what they would do if they were the owners.

In the next section, we will present the game aspects in *AEINS* and how they have been evaluated against Gee's games criteria.

THE EVALUATION OF *AEINS* AGAINST THE GAMES' CRITERIA

In 2004, Gee published a condensed list of 13 principles of learning that should be built into good computer and video games. According to Gee (2004), the stronger any game is on more of the features on the list, the better its score for learning. Following the definitions provided in this list, this section describes the extent *AEINS* managed to achieve Gee's principles.

Empowering students is a principle that can be achieved through other principles, which are co-design, customize and giving students identities. **Co-design** is related to the players a feeling of control over the game by actively creating part of their experience and having an effect on the virtual world. In *AEINS*, this principle is applied. The student can take actions that influence how the story unfolds. In addition, the teaching moments' settings allow the student to act and apply his beliefs in various situations showing the impact of the student's actions in the short term and long term on the teaching moment story. **Customize** is the player's ability to influence the game play. *AEINS* partially supports customization through offering a personalized story and individualized learning process, but it does not offer different learning styles such as text, graphics, or audio; neither does it consider gender nor offer multiple interfaces for individual preference**. Identity** is an attribute that aims to foster motivation by allowing students to feel ownership by immersing players in an alternate reality where they take on a different identity. In *AEINS*, the player chooses a playing character to represent them in the virtual world and chooses friends from a group of non-playing characters (semi-autonomous agents). The player character has no history and the student can build it through his action choices that reflect his beliefs, in the game world. If the player succeeds in bridging the real identity and the virtual identity in the game, they should be motivated to learn the ethical values and skills to help that character succeed.

Manipulation and distributed knowledge is a principle that deals with actions and offering the player characters to move intricately, effectively and easily through the world. *AEINS* has partially achieved this aspect through the use of 2D interface and on-screen text to interact with the game. Knowledge distribution deals with knowledge split between the person playing the game and the virtual character. For example, the virtual character knows how to move in the environment and how to make friends, but the player knows when to do this and why. The *AEINS* design offers the virtual character that represents the student in the virtual environment. It helps the children to build a powerful bridge between their real identity and this virtual identity in order to progress in the game.

Problem solving and well-ordered problems are principles that are concerned by how skills gained in solving earlier problems help in solving further, more difficult, problems *AEINS* provides different levels of moral dilemmas that present various ethical concepts and reinforce desirable attitudes. The more the student practices and proceeds in the game the more complex conflicts will appear. Skills gained in solving simpler problems should help the student to solve more complicated conflicts. **Pleasantly frustrating** is a principle that deals with the appropriate challenge level that should be offered to the students. *AEINS* allows this through offering different level dilemmas that challenges the student at different knowledge levels.

Expertise is formed in any area by repetitive cycles of students practicing skills until they are nearly automatic, then having those skills fail in ways that cause the students to have to think again and learn anew. As mentioned throughout this chapter, in *AEINS*, each new dilemma (teaching moment) brings a new challenge that builds on previously-learned skills. Students

advance between levels when a certain amount of proficiency is reached. Then they continue to practice those skills in the service of higher level goals. Practice helps the student to automate the new knowledge and feel pride in their growing expertise. As skills become automated, they serve as components in the higher level strategies that the students learn. This satisfy the cycles of expertise principle. Gee sees that humans are not efficiently capable of using verbal information (words). In *AEINS*, the player initially receives a brief introduction about the world and what should be done. Then the student is left to explore the environment by himself. *AEINS* is able to provide information on-demand and just-in-time.

Fish tanks are those simplified versions of the main game that allow tutoring and practicing in order to understand the game as a whole system. *AEINS* has not tackled this point. With regard to **sand boxes**, Gee defines the term as follows: students are put into a situation that feels like the real thing, but with risks and dangers greatly mitigated, they can learn well and still feel a sense of authenticity and accomplishment. In *AEINS*, this has been attempted in the design of teaching moments that provide realism in the game and social contexts. The game story elements are designed to motivate the student to learn ethical skills.

Gee found that people do not like practicing individual skills over and over in a meaningless context. However, they gladly practice a set of related skills as a strategy to accomplish designed goals. *AEINS* allows practicing individual skills as well as the applications of more than one skill through providing different interactive contexts and situations.

System thinking, understanding and meaning as action image are three further principles. People learn skills, strategies, and ideas best when they see and understand how they fit into an overall larger system to which they give meaning. The player learns most effectively when he understands his role within the system and can use that knowledge to set goals and determine actions (Hastings, 2009). The *AEINS* environment allows the student to picture himself in the virtual world and how he fits in, in addition to how his actions affect himself and others. Each *AEINS* story is generated in a way that gives the student this type of system within which to learn and practice ethical and moral skills. It was designed to provide the student with the conceptual connections required for learning with understanding. Moreover, humans do not usually think through general definitions and logical principles. Rather, they think through experiences they have had. It is the person's own experience that gives meaning to their words. Gee's opinion is that games can have marvelous effects if they succeed to tie words and concepts to actions in the world. In other words, by linking perception to action, the conceptual learning is strengthened and the student's experience is enriched. As we have discussed before, The *AEINS* design is all about situating the learning and use of ethical skills within a rich context that enables the player to learn with deep understanding.

In the next section, we will present the empirical study done to test *AEINS* on the technical side, the social effect and the educational outcomes.

EMPIRICAL STUDY

A study was done to test the developed educational game, *AEINS*. In designing this study, it was determined that the best way to approach it was to rely on a qualitative evaluation method to elicit users' thoughts. Since the participants were children, the use of in-depth, open-ended interviewing seemed the appropriate method to capture the interviewees' experiences and perspectives on the program being evaluated. It helped the participants to express their experiences and judgments in

their own terms. The resulting data consists of quotations with sufficient context to be interpretable.

Twenty participants were randomly assigned to play with *AEINS* over a number of games. Their age was between 7 and 12 years old (15 male, 6 female, mean=9.6). The children were all an opportunistic sampling from schools in York who voluntarily agreed to use *AEINS* with their families' permission. The participants were of different origins and had different cultural backgrounds.

Prior to each experiment, demographic data was collected for each participant along with an informed consent form, signed by their parents. The participants were interviewed individually. The *AEINS* environment was briefly introduced to each participant. The participants were encouraged to explore the environment themselves and provided with the required privacy. Participants were explicitly told to be themselves while interacting with *AEINS*. The participants' reactions during their interaction with *AEINS* were watched and recorded. The participants worked at their own pace and all their actions were recorded by *AEINS* to be analyzed later. *AEINS* did not allow the participant to change their minds regarding their taken actions, because this is what can happen in real life and thus, the participant will experience the effects of his choices on himself and on others.

To evaluate *AEINS*, students' log files have been examined and post-participation interviews were conducted that focused on five different categories: The first category included questions related to the technical infrastructure and its functioning. The second category included questions related to the functions and features inherent in the system and its ability to support or enable a specific activity. The third category included questions related to the participant tasks. The fourth category included questions related to the capability for specific technology-based activities to generate predicted outcomes. And finally the fifth category included questions related to the re-playability and self reflection.

By looking at the student's log files and tracing the teaching moments' presentation, it has been found that the student model is able to identify the student's needs and present the teaching moments accordingly (address individual needs). By the end of the whole experience, the student will have truly experienced some emotional and moral complexities appropriate to their current moral understandings. This kind of experience, especially when complexities develop over the course of a game-like environment, can leave the player wiser (Freeman, 2004).

Results are organized around the main themes reflected by the data. These three themes are: *AEINS* architecture and implementation, social aspects in *AEINS*, and learning deployed in *AEINS* and educational achievements.

Results

The *AEINS* interface is a simple interface. However, some participants were slow to acquaint themselves with the game, but after a short time they became quicker and much more immersed. The interface uses check boxes to handle the student's actions or choices. It allows more mouse clicks to interact with the game world and multiple-line text boxes to present the story, and stores every single action in the environment. This allows the student, at any time, to see past actions to solve a conflict or judge certain actions based on previous ones.

Interacting with *AEINS* has been shown to be an enjoyable experience for most of the participants, *AEINS* was described by P11 as an environment where you can try wrong things and see what would happen. P5 said the following about *AEINS*: ".... very million times good." and added "It tries to make you behave well in real life, this is your training to be good." Another participant, P6, said: "I enjoyed finding new situations, meeting the characters and solving problems for them," and added "I like the idea of facing situations in different places"

Moreover, the story in *AEINS* has been described as connected by P5, fun as judged by P13 and by P6 as defined and interesting. Another participant, P18, added: "the whole story is quite organized. It is good and simple...., it gives a variety of options and characters."

The evaluation shows that children appreciate the social characteristic in the system, as they were able to recognize the genuine social aspects and the realism represented in the game. The analytical questions confirm this recognition. For example, participants clearly cared about the outcome. For example, P15: "The best moment was when my parents and my teacher were proud of me because of what I had done." Another participant felt **good** when the teacher told the parents that he told the truth and he was rewarded by going on a nice summer holiday. This quote and others, like P6: "I was **upset** when my friend said that she will not be my friend anymore." These quotes show that *AEINS* succeeded to have an emotional effect on the participants where they can feel good, bad, scared, surprised. Therefore, we can argue that emotional engagement is another positive point *AEINS* provides.

It seems that *AEINS* was able to make them feel that they are really involved in realistic situations and consequently they were acting accordingly. More evidence that the participants were recognizing the social situation and recognizing the non-playing characters as real friends have appeared in the following quotes: P5:"I felt as if I am in a real world and these characters are really talking to me, they were very believable." Another participant, P6, said, "I did not mean to upset my friend, I felt as if it really happened and I had lost my friend who will not talk to me ever again. I think I will be careful next time."

Actually, what was most interesting is the way the participants personalize the non-playing characters in the game. They do not only interact with them as their friends in the game but also they gave them lives and they were picturing how these characters behave beyond these moments. For example one interviewee, P2, said, "I do not like Gina when she lies, I want to tell her that this is wrong and she has to stop lying." The interviewee added "If she keeps doing this now, no one will believe her in the future."

The participants also believe the non-playing characters personalities: they like some and dislike others. For example, one participant describes one of the non-playing characters as funny. Another participant said that the non-playing character 'Gina' is not a real friend as she always ask him to do something wrong, which is something real friends do not do. ,

The realism present in *AEINS* allows the participants to think about the non-playing characters as real friends who can feel and expect certain actions from them. For example, one participant, P7, quoted: "If I choose to be on the side of one friend, the other one could become angry." another participant, when asked about the non-playing characters said the following: P6:"They rely on me. They ask me to solve their problems. They need my help." However, when asked if any of them has behaved in a strange way, he replied. " They are trying to make me cheat, *real friends* do not do this." [Italics added]

This theme is very important as it tends to show that *AEINS* is an effective learning environment and is able to deliver effective learning, in other words develop the participant's reasoning process. The use of the Socratic Method as the teaching pedagogy shows success. In every teaching moment, an agent who exhibits certain personality characteristics uses the Socratic Voice to raise the moral conflict. This pushes the student to think harder to solve the discrepancy inherent in these situations. For example, from P11's log file, it has been found that the student followed the following path in the shoplifting dilemma: agree to help his friend to take a chocolate bar without paying for it, then undertake a discussion with the good moral character, who uses the Socratic Voice. The discussion ended by a change in the student behavior where he admitted he made a mistake and asked his friend to return the chocolate. In the post-participant interview with P11, he mentioned that he made a mistake by helping Gina (the immoral character in the shoplifting dilemma) to take the chocolate. This corresponds well with the results obtained from the log file. Such changes in attitude reflect the power of the Socrates Method in forcing the student to face the contradictions present in any course of action not based on good moral principles.

One participant liked the fact that she can interact with the teaching moments and is able to see the effect of her decisions on herself and others. This interviewee asked to restart the game when she has been faced by negative consequences as a result of one of her choices. This shows that although the feedback was implicitly provided in the story, it manages to deliver the message (you did something wrong) which was not appropriate to be said explicitly as we discussed before. In the post-participant interview, it seems that the interviewee has an explicit representation about taking belongings. This appears in her final comment: P13: “Taking other people’s stuff is stealing and we should not take something without asking first.”

We claim that the interactive teaching moments were able to provide the appropriate hints about various moral actions and situate the students in different mental and emotional states. Moreover they allow the student to attempt the high levels of Bloom's taxonomy such as Analysis. For example, the participants were analyzing the situations, where conflict exists, and trying to find a solution to the current dilemma as quoted by P4: “It was difficult to take a decision as it can make my friend upset.”

In the next section, we will discuss the main ideas presented in this chapter and the results obtained from the above evaluation.

DISCUSSION

This chapter presented the idea that integrating different educational game features has been shown to individually increase the effectiveness of various educational games, such as dynamic generated narrative, scripted narrative, student modeling and the presence of continuous story. The integration of dynamic generated and scripted narratives allows high user agency but also allows the educational game to track the learning process and assess it. The presence of a student model provides a personalized learning process. Finally, the continuous story allows the presence of evolving non-player characters that engage the student and increase the realism and believability of the environment. Although each individual attribute is not innovative in itself, their integration in one environment is.

Moreover, this chapter discussed problems encountered in classroom environments while teaching ill-defined domains such as ethics, and how computers can act as a solution. In the ethics domain, *AEINS* can act as an assistant tool in teaching the ethics curriculum, especially with its ability to provide summary reports, based on the student model, for individual students. Such reports help the teachers to identify the students' weak points in a quick and easy way solving time constraints in the classrooms. The teachers can decide on upcoming educational materials which suit the majority of the class.

AEINS offers a compelling virtual world and virtual identity, at some level, where deep learning is able to occur. It can be noticed that the children were able to build a powerful bridge between their real identity and this virtual identity in the game. They did have emotional responses that transfer their real world responses to the game. This goes well with Gee's discussion about learning and identity and his illustration of the importance of children being able to build these bridges (Gee, 2004b).

AEINS has been designed as an endogenous game, not an exogenous one. In exogenous games, the learning content is often added into a general game framework like a quiz show or a shooter game. Researchers prefer endogenous games where the content material is intimately tied in with the game play, because of their theoretical advantage in learning effectiveness (Hastings, 2009). From the very beginning, we were aware of the importance of having the educational tasks weaved into the games directly and progress in the game should depend only on acquiring the required skills. We created multiple stories that are connected to a main story in which the player is put into a position where he must use the skills that we are trying to reinforce. Inability to perform the skills will bring feedback and extra practice. Mastery of the skills will bring success and progress within the game

Children became engaged in the game, all participants agreed on how interesting it was solving conflict situations especially between their friends and how this can be difficult sometimes. We believe that the interactive dilemmas in *AEINS* succeeded to induce moral interpretations. What is happening here fits well with Gee (2004b) and his theory about "what video games have to teach us" and how students can be unwilling to put in the effort and practice demanded for mastering a domain if this compelling component is missing. The fun provided by *AEINS* and the associated curiosity exists from the presence of various unexpected ends for the same teaching moments (learning objects) helped the participants to get immersed in the game and put the effort into solving the required tasks. In addition to the appropriate challenge level provided in the learning tasks as a result of the presence of an individualized student model built for every particular participant.

To be able to assert that deep learning has occurred in an ill-defined domain like ethics requires some kind of transformation in the way a person thinks. Through the children's experiences with *AEINS*, it has been found, that they were using their real identities. They were applying their own beliefs and experiences from their lives in the game. For example, one of the participants did not like the homework scene presented to him when he was interacting with *AEINS* and when asked why? He answered that he does not like doing homework in real life.

However, this does not mean that every child has only one identity: it is actually a combination of various real identities mixed up together. Some of these identities appear in certain situations or under certain circumstances. With their ability to build this bridge between their real identities and the virtual one, the real identities are enriched with this new identity that can also appear in

real situations. Gee (2004b) discusses this kind of unity, mentioning that if children are learning deeply, they will learn through their projective identities, new values and new ways of being in the world based on the powerful combination of their real world identities and the virtual identity at stake in the learning.

The post-participant interviews showed they had been inspired by the system. Some of them commented that they would be happy to take the system home and spend time with it. This provides evidence that they do have a pleasant experience. Among this group, the students gave the software a subjective evaluation and generally had a number of constructive suggestions about how to make the software better. The delivery platform was subsequently improved based on feedback from these evaluations.

Overall, we believe this research provides students with a practical means of exploring abstract issues in concrete settings, allows students to practice making ethical decisions in a realistic context and enables them to see various consequences in a safe environment.

Recommendations Summary

Based on the experience of developing and testing *AEINS,* we developed a set of recommendations and considerations for creating games that support character education.

I. **First player perspective.** Allow the player to join the game as a first player to maximize the opportunity of situated learning and self reflection on their own experiences.

II. **Use various challenging levels.** Make sure that the players can explore the world in different ways and the game provides the appropriate level of challenge where the difficulty level increases gradually.

III. **Variable experience.** Make sure that the player is faced by different experiences over multiple play times. This can be achieved through the presence of a student model.

IV. **Incorporate multiple perspectives.** Integrate diverse views on the same topic or situation, and place different types of people into the world so that players can interact with many types of ideas and beliefs, which can lead to deliberation with others, as well as reflection on one's own views.

V. **Presence of synthetic characters.** Show the emotional impact of actions on the non-playing characters to increase the world believability, allow the players to build relations with them, to care about them and be committed to them.

VI. **Provide feedback.** Make sure that players relate the feedback to their choices and actions. And that they understand how their choice led to a consequence.

VII. **Positive and negative rewards.** Make sure the game provides positive as well as negative rewards that help the player to evaluate how his actions led to a certain kind of reward.

Future Research Directions

In this chapter, we have proposed an Adaptive Educational Interactive Narrative System (*AEINS*) that helps to teach ethics. While *AEINS* has been successful in many aspects, there is still room for further development. Specifically, the following aspects of the system could be improved:

- Enhance the graphical user interface to be 3D; this kind of interface offers visual appearances that attract human attention, especially children. The 3D interface will allow the presence of animated pedagogical agents that positively serve the educational process.

- Develop an authoring tool to help teachers with no or weak programming skills to author teaching moments in an easy way.
- Create a bigger story world to allow the presence of larger sets of actions the student can take. In turn this would increase the student's freedom and agency within the environment.
- Enhance the student-system interaction by using a full natural language engine; this would facilitate human computer interaction and allow free expressions, which in turn could cause more difficulties in analyzing the student's knowledge and intentions.

REFERENCES

Abraham, D. & Yacef, K. (2002). Adaptation in the Web-Based Logic-ITA. *Lecture Notes in Computer Science: Adaptive Hypermedia and Adaptive Web-Based Systems*, 456-461. ISBN978-3-540-43737-6.

Anderson, R. C., Reynolds, R. E., Schallert, D. L., & Goetz E. T. (1977). Frameworks for comprehending discourse. *American Educational Research Journal, 14*, 367-381.

Anderson, R. C. & Pichert, J. W. (1978). Recall of previously unrecallable information following a shift in perspective. *Journal of Verbal Learning and Verbal Behavior, 17*, 1-12.

Aylett, R., Vala, M., Sequeira, P. & Paiva, A. (2007a). FearNot! - An Emergent Narrative Approach to Virtual Dramas for Anti-bullying Education. *International Conference on Virtual Storytelling 2007* (pp. 202-205).

Aylett, R., Louchart, S.,Tychsen, A., Hitchens, M., Figueiredo, R. & Mata, C. D. (2007b). Managing emergent character-based narrative. *Proceedings of the 2nd international conference on INtelligent TEchnologies for interactive entertainment (INTETAIN '08)* (pp.1-8). Cancun, Mexico.

Avner, A., Moore, C., & Smith, S. (1980). Active external control: A basis for superiority of CBI. *Journal of Computer-Based Instruction, 6*(4), 115-118.

Barber, H. & Kudenko, D. (2007). A user model for the generation of dilemma-based interactive narratives. *Workshop on Optimising Player Satisfaction (AIIDE'07).* Stanford, California.

Bayon, V., Wilson, J. R., Stanton, D. & Boltman A. (2003). Mixed reality storytelling environments. *Virtual Reality Journal, 7*(1). Springer London (Pub.).

Bell, P. and Linn, M. C. (2000). Scientific arguments as learning artifcats: Designing for learning from the web with KIE. *International Journal of Science Education, 22*(8), 797-817.

Bergin, D. A. (1999). Influences on classroom interest. *Educational Psychologist Journal, 34*(2), 87-98.

Bolton, G. (1999). *Acting in classroom drama: A critical analysis*. Birmingham: Trentham Books.

Brusilovsky, P. (1994). Student model centered architecture for intelligent learning environments. Proceedings of Fourth international conference on User Modeling (pp. 31-36). Hyannis, MA, USA. User Modeling Inc.

Daeg de Mott, D. K. (2001). Kohlberg's Theory of Moral Reasoning. *In Encyclopedia of Childhood and Adolescence.*

Eiriksson, S. (1997). Preservice Teachers' Perceived Constraints of Teaching Science in the Elementary Classroom. *Journal of Elementary Science Education*, 18-27.

Elkind D. H. & Sweet, F. (1997). How to do character education. Retrieved from http://www.goodcharacter.com

Freeman, D. (2004). *Creating emotions in games. The craft and art of engineering*, p. 157. New Riders Publishing..

Gagné, R.M., Wager, W.W., Golas, K.G. & Keller, J.M. (2005). *Principles of instructional design*. Toronto, ON: Thomson Wadsworth.

Gee, J. P. (2004a). *Situated Language and Learning: A Critique of Traditional Schooling*. Routledge, London.

Gee, J. P. (2004b). *What Video Games Have to Teach us About learning and Literacy*. Palgrave Macmillan.

Gunter G. A., Kenny R. F. and Vick E. H. (2006). A case for a formal design paradigm for serious games. *Journal of the International Digital Media and Arts Association, 3*(1), 93-105.
Harless, W. G. (1986). An Interactive Videodisc Drama: The Case of Frank Hall. *Journal of Computer-Based Instruction, 13*(*4*), (pp. 113-116).

Halverson, S. (2004). Teaching Ethics: The Role of the Classroom Teacher. Association for Childhood Education International (ACEI) Subscriptions. Retrived from: http://www.acei.org.

Hastings, P., Britt, A., Sagarin, B., Durik, A., and Kopp, K. (2009). Designing a Game for Teaching Argumentation Skills. *In Proceedings of workshop on intelligent educational games, at the 14th International Conference on Artificial Intelligence in Education (AIED09)*, Brighton, UK

Hodhod, R. & Kudenko, D. and Cairns, P. (2009, April). Serious Games to Teach Ethics. *In proceedings of AISB'09: Artificial and Ambient Intelligence*. Edinburgh, Scotland, UK.

Johnson, W., Marsella, L., S. and Vilhjálmsson, H. (2004). The DARWARS Tactical Language Training System. *Proceedings of the 26th Interservice/Industry Training, Simulation, and Education Conference* (I/ITSEC). Orlando, FL.

Keller J. M. (1987). Development and use of the ARCS model of instructional design. *Journal of Instructional Development, 10*(3), 2-10.

Kim, N. (1989). Circsim-tutor: an intelligent tutoring system for circulatory physiology. Illinois Institute of Technology, Adviser-Martha, W. E., Chicago, IL, USA.

Kohlberg, L. (1984). The Philosophy of Moral Development: Moral Stages and the Idea of Justice. *Essays on Moral Development, vol. (1)*, New York: Harper and Row.

Koslowski, B. (1996). Theory and Evidence: The Development of Scientific Reasoning. Cambridge MA: MIT Press.

Kuhn, D. (1993). Science as argument: implications for teaching and learning scientific thinking. *Science Education Journal, 77*(3), 319-337.

Lane, H. C., Core, M. G., Gomboc, D., Karnavat A., & Rosenberg, M. (2007). Intelligent tutoring for interpersonal and intercultural skills. *Proceedings of Interservice/Industry Training, Simulation and Education Conference (I/ITSEC)* (pp. 1–11).

Lickona, T., Schaps, E. & Lewis, C. (2007). Eleven Principles of Effective Character Education. Character Education Partnership.

Lynch, C., Pinkwart, N., Ashley, K., & Aleven. V. (2008, June). What Do Argument Diagrams Tell Us About Students' Aptitude Or Experience? A Statistical Analysis in an Ill-Defined Domain. *In proceedings of a workshop held during ITS-2008. The 9th international Conference on Intelligent Tutoring Systems.* Montreal, Canada.

Magerko, B. S. (2006). *Player modeling in the interactive drama architecture.* University of Michigan: Department of Computer Science and Engineering.

Magerko, B. S. and Stensrud, B. S. (2006). Bringing the schoolhouse inside the box-a tool for engaging, individualized training. *Proceedings of the 25th Army Science Conference*, Orlando, FL.

McBrien, J. L. & Brandt, R.S., (1997). The language of learning: A guide to education terms. *Association for Supervision and Curriculum Development*, 17-18. Alexandria.

Mckenzie, A. & Mccalla, G. (2009). Serious Games for Professional Ethics: An architecture to support personalization. *Proceedings of Workshop on Intelligent Educational Games - AIED 2009*. Brighton, UK

.

Meacham, J. A. and Emont, N. M. (1989). Everyday problem solving: Theory and applications. In J. D. Sinnott (Ed.), *The interpersonal basis of everyday problem solving* (pp.7-23). New York: Praeger.

Mergel, B. (1998). Instructional Design & Learning Theory. Retrieved from: http://www.usask.ca/education/coursework/802papers/mergel/brenda.htm

Prada, R., Machado, I., & Paiva, A. (2000). Teatrix: A virtual environment for story creation. *Proceedings of the 5th International Conference on Intelligent Tutoring Systems (pp.* 464-473). Springer Verlag.

Riedl M., & Stern, A. (2006). Believable agents and intelligent story adaptation for interactive storytelling. *Proceedings of 3rd International Conference on Technologies for Interactive Digital Storytelling and Entertainment*. Darmstadt, DE.

Shapiro, D. A. (1999). Teaching ethics from the Inside-Out: Some Strategies for Developing Moral Reasoning Skills in Middle School Students. *Seattle pacific University Conference on the social and Moral Fabric of School Life.*

Shortliffe, E. H. (1981). Consultation systems for physicians: the role of artificial intelligence techniques. In B. L.Webber, and N. J. Nilsson, (Eds.), *Readings in Artificial Intelligence* (pp. 323-333). Tioga Publishing Company, Palo Alto, California.

Silva, A., Raimundo, G., & Paiva, A.(2003). Tell me that Bit Again. Bringing interactivity to a virtual storyteller. *Proceedings of the 2nd International Conference on Virtual Storytelling*. Springer, ICVS

Simon, H. A. (1973). The structure of ill-structured problems. *AI, 4*, 181–201.

Simpson, D. (1998). Dilemmas in Palliative Care Education. *Palliative Medicine, 1* (2).

Thomas, J. M., & Young, M. (2007). Becoming scientists: Employing adaptive interactive narrative to guide discovery learning. *Proceedings of AIED-07 Workshop on Narrative Learning Environments*. Marina Del Rey, California, USA.

Vilhjalmsson, H., Merchant, C., & Samtani, P. (2007, August). Social Puppets: Towards modular social animation for agents and avatars. *Lecture Notes in Computer Science* (pp. 192–201). Springer Berlin / Heidelberg (Pub.).

Waraich, A. (2004). Using narrative as a motivating device to teach binary arithmetic and logic gates, SIGCSE Bull, 363, 97–101, ACM (Pub.). New York, USA.

Watson C. E. (2003, May). Using stories to teach business ethics – Developing character through examples of admirable actions. *Journal of Teaching Business Ethics, 7*(2), 93-105, Pub. Springer Netherlands, Collection Humanities, Social Sciences and Law.

Yang, F., Kim, J. H., Glass, M. & Evens, M. W. (2000). Turn Planning in CIRCSIM-Tutor. *Proceedings of the Thirteenth International Florida Artificial Intelligence Research Society Conference* (pp. 60-64).