Moodle my style: e-learning improves attributional style for cancer-diagnosed children

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Abstract: Metacognitive skills and a positive attributional style are extremely important for young cancer patients. The present research shows how attributional styles and metacognitive training via information and communication technologies (ICTs) can enhance a positive self-attributional style in young cancer patients. A quasi-experimental prospective study measured participant attribution style before and after metacognitive and attributional online training programs that last about six months. Results demonstrated a significant positive impact of training on metacognitive skills and attributional style. The program presented expands knowledge on the prevention of negative cognitive long-term side effects associated with the treatment of children with cancer.

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1   Introduction

About 1,380 children (age 0–14 years) and 780 teens (ages 15–19 years) are diagnosed with malignant tumours in Italy each year (Pession and Rondelli, 2013). These incidence rates are higher than those found in the USA as well as those found in Northern European countries (Kaatsch, 2010; Pritchard-Jones et al., 2006). For children aged 0–14 years, cancer is the second leading cause of death, after accidents, with a fatality rate of

2.8–3.5 deaths per 100,000 children (Bosetti et al., 2010). Recently, due to remarkable progresses in paediatric oncology the child mortality rate has decreased dramatically (Bosetti et al., 2010) in no small part due to the significantly reduced hospitalisation times. Indeed, in Italy survival rates exceed 60–70% (Adduci et al., 2011) while in other industrialised countries it has been found to reach about 80% (Lurie and Kaufman, 2001).

Cancer treatment is often a long and complex process that varies according to tumour pathology. After treatment (chemotherapy, radiation and surgery) discontinues, a period of monitoring follows, consisting of a series of periodic checks. These checks extend over time, and the child is considered cured if there are no relapses during the three years post-starting of the treatment.

Even if these treatments succeed in curing the disease, they often cause psychological, emotional, and behavioural problems. When diagnosed with cancer the child's whole world suddenly changes (Capurso, 2006). Long periods of isolation and hospitalisation may limit motor, sensory, and social experiences necessary for proper brain maturation. Even more so in older children and adolescents, this situation of deprivation and constraint can have consequences on school learning and the development of life skills (Mitby et al., 2003). For adolescents, agitation, confusion, as well as attentional and executive difficulties result in learning difficulties (Butler and Copeland, 2002; Butler and Mulhern, 2005; De La Paz et al., 1998; Nicolson and Fawcett, 2007). In particular, both voluntary and reflexive attention mechanisms are thought to play a crucial role in establishing internal memory representations (Botta et al., 2010; Pedale and Santangelo, 2015; Santangelo, 2015), and, therefore learning processes (Amso and Scerif, 2015). In terms of education, problems abound that are either directly connected to the disease and its side effects, with school of origin, hospital teaching and classmate relationships, long hospital stay and prolonged absences, or simply getting behind on school work (Adduci et al., 2011; Capurso, 2014).

In this paper, we present a study conducted with adolescent cancer patients where we measured participant attribution style before and after undergoing a metacognitive and attributional online training in a moodle-based learning virtual learning environment (VLE) that lasted about two years. We begin by discussing the psychological impact of childhood illnesses, for example, cancer, before reviewing research on attributional styles and how they have a positive impact on learning, especially for children with chronic illnesses. We then discuss recent findings on information and communication technology (ICT) and illnesses before we turn our attention to our present research.

1.1 Psychological impact of illness for children

Many cognitive, psychological, and social consequences arise due to long periods of isolation. In fact, about one quarter of children with cancer repeat their class while about half have learning difficulties and the risk of failing is about twice as much as their healthy peers (Harila-Saari et al., 2007; Pavri and Monda-Amaya, 2001; Shiu, 2001).

Post-traumatic stress disorder, increased aggression, hyperactivity, decreased self-efficacy beliefs and self-esteem/self-confidence, withdrawal, passivity are all more likely for children with cancer when compared to their healthy peers (Rennick et al., 2004). Children with cancer have been found to be less likely to have close friends (Barrera et al., 2005), more likely to be victims of bullying (Hildenbrand et al., 2011; Van Cleave and Davis, 2006), and more likely to experience social consequences related

to appearance changes, such as loss of hair, and swelling of the face and body (Shiu, 2001).

Several studies show how proper educational and psychological education programs may counteract the short- and long-term side effects of the disease and subsequent therapies (Mitby et al., 2003). For instance, Zou et al. (2016) found evidence of sustained neural and behavioural benefits of a prophylactic reading intervention administered during radiation therapy in children treated for medulloblastoma. A study by Butler and Copeland (2002) similarly reported statistically significant improvement on several attention measures, in a group of off-therapy cancer survivors with documented attention deficits, who participated in a psychologically-based outpatient rehabilitation program, aimed at improving dysfunctional attention processes and associated neuropsychological deficits.

1.2   Metacognitive skills – attribution theory – De Beni

One important aspect to nurture in children with cancer is their metacognitive capabilities (Butler and Mulhern, 2005; Spencer, 2006). Weiner's (1985) attribution theory describes and explains how one attributes causes of successes and failures based on three dimensions: locus of control, stability, and controllability. Locus of control can be internal, when one thinks that success or failure is linked to their own behaviours, or external, when one thinks that success or failure is linked to events or the behaviours of others. The person can then perceive each cause as either controllable and stable or not controllable and unstable over time. For instance, if one thinks that school performance is due to studying, this demonstrates an internal locus of control where the relationship between cause and effect is controllable and stable. Whereas if one thinks that school performance is due to luck, this demonstrates an external locus of control where the relationship between cause and effect is not controllable and unstable. The interweaving of three different aspects of attribution (i.e., locus of control, stability and controllability) helps to create an attributive style that is unique to the person (Weiner, 1985).

With the attribution questionnaire, De Beni and Moè (De Beni and Moè, 1995, 2000; Moè and De Beni, 2002) identify five main attributive styles that contribute to success in school. This questionnaire has been typically directed for young people aged 11–19 (but even adults) and evaluates a general attributional pattern by asking participants to select one of five possible causes (effort, ability, task, external help, and luck) for the 24 situations (half successful/failures) proposed on the questionnaire.

Previous research demonstrates how illness can moderate attribution style for ill children. For instance, Frank et al. (1997) reported a higher than normal depressive attributional style in a group of 86 paediatric oncology patients. Other studies suggest that children with serious chronic diseases such as cancer tend to develop an external-oriented locus of control (Engström, 1991), even if Nowicki and Strickland (1973) research showed how some specific diseases like diabetes can favour an internal locus of control, probably due to strong involvement of the patient in the management of the disease. The construct of locus of control is particularly important to children with a medical condition because it has been shown to be a useful predictor of the ability to cope with severe chronic illness. Children with an internal locus of control adjust better to the disease making treatment more effective due to their a greater involvement and responsibility in the management of the disease and locus of control can be a good indicator of the quality

of life of these kids (Leventhal et al., 1992; Lefcourt and Davidson-Katz, 1991; Mullins et al., 1997).

1.3 ICT and ill children

To help continuity in education of children with a medical condition, the use of ICT tools is becoming more popular (Maor and Mitchem, 2015). By creating a virtual 'bridge' between school and the hospital/home, ICT can help to limit problems caused by the disease by helping the child to manage their emotions and counteract depressive attitudes (Capurso, 2006). Such a connection is vital for the academic, social, and emotional development of ill children (Brimeyer, 2012; Lightfoot et al., 1999; Wallander et al., 2003, 1989). A tool often used that supports the home and hospital education of ill children is VLEs and specific e-learning platforms (Liebhardt et al., 2012; Zhu and Van Winkel, 2016; Rajaei and Aldhalaan, 2011).

The metacognitive/attributional training program used a moodle-based VLE. Moodle is an open source platform that is widely used as an ICT for online educational purposes (Sife et al., 2007). VLE's in general, and moodle in particular, allow students and teachers to work with numerous objects such as videos, mp3s, text documents, scanned images, links to other websites or animations which can be used to dynamically illustrate concepts that might be difficult to comprehend using traditional materials. Moodle provide tools for the assessment, communication, uploading of content, return of students' work, administration of student groups, questionnaires, tracking tools, wikis, blogs, chats, forums, etc. all within a online environment (Weller, 2007).

Several reasons guided the choice of moodle:

1 moodles create both safe and secure environment for ill children

2 moodles provide a comfortable and fast way to deliver things like activities, links, slides, lessons, tests, quizzes, homework assignments and other learning resources

3 moodles help create a social space where students are able to communicate and interact with each other and with the course's tutor

4 moodles include both synchronous and asynchronous communication within a flexible schedule.

1.4 Our study: e-learning improves attributional style for cancer diagnosed children

An attributional and metacognitive training was created with the aim of enhancing a positive self-attributional style in young people with cancer. With the present research, we wanted to answer to the following research questions:

1 Does cancer influence the locus of control that children make for success/failure?

2 Is a metacognitive and attributional training run through a VLE effective in improving such cognitive qualities in adolescents diagnosed with cancer?

2   Method

2.1   Design

A quasi-experimental prospective design was used where participant attribution style was measured before and after metacognitive and attributional online training.

2.2   Participants

Thirty-one children (22 male and nine female) aged 11–19, (M =15), who were recently diagnosed with cancer (within the last 24 months), participated in the study. Sixteen were currently in treatment while fifteen stopped treatment within the last year. Patients were being treated in three public hospitals in northern Italy, (i.e., Aviano, Trieste, Padova). Seventeen children attended middle school, 12 were in high school, and the remaining two were in their first year of university. Twenty-six participants completed the training in its entirety while five participants were not able to complete the training due to illness complications. The frequency and type of oncological disease were: 13 Acute Linfoblastic Leukemia, 4 Non-Hodgkin's Lymphoma, 3 Central Nervous System, 3 Ewing Sarcoma, 2 Sarcoma, 2 Hodgkin's Lymphoma, 1 Aplastic Anemia, 1 Ependymoma, 1 Acute Myeloid Leukemia, and 1 Rhabdomyosarcoma. All participant parents gave their written informed consent. To allow for better age-related communication, participants were divided in two-age groups (11–13 and 14–19 years).

2.3   Materials

2.3.1   Informative questionnaire

An ad-hoc informative questionnaire ('*Io e la Tic*') assessed technology use at home and in the hospital. The questionnaire included specific questions about social networks, online tools, and the informal use of ICTs in the hospital and home school.

2.3.2   Attribution questionnaire

The attribution questionnaire (De Beni and Moè, 1995) assessed participant attributional style. For each of the 24 situations proposed on the questionnaire, participants are asked to select one of five possible causes (effort, ability, task, external help, and luck). Half the situations proposed describe successful outcomes while the other half describes failures. Total administrate time for this questionnaire is about 30 minutes. Previous research by De Beni et al. has revealed the following Chronbach's alpha reliability data: effort = .61, lack of effort = .63, ability = .71, inability = .61, ease of task = .56, task difficulty = .55, good luck = .67, bad luck = .68, presence of assistance = .61 and lack of assistance = .66.

2.3.3   VLE training

A moodle-based VLE was used for the metacognitive/attributional training program. The moodle environment used for this research included all of the tools necessary for the assessment, communication, uploading of content, return of students' work, administration of student groups, questionnaires, tracking tools, wikis, blogs, chats, forums, etc., all within a online environment (Weller, 2007).

2.4 Procedure

Participants first completed the 'Io e la Tic' informative questionnaire and then the attributional questionnaire. Both questionnaires were completed during a Skype session with one of the authors and took about 10 minutes each to complete, with a short break in between each questionnaire,

Following the completion of the above questionnaires, participants began the training program that was delivered in three phases (i.e., reception, exploratory and enhancement). During the first phase, participants were encouraged to interact within the moodle VLE, while during the second phase five modules were presented. The modules discussed in the following order: motivation, study skills, learning styles, anxiety and stress management, and attribution and self-perception and were designed to offer effective study methods. These five modules were designed to offer effective study methods. These modules did so by suggesting strategies included methods for improving memory, making connections and comparisons with pre-existing and currently learned knowledge, summarising and outlining newly acquired knowledge with concept maps, learning how to take notes, and techniques for improving time organisation all with the goal of improving motivation and commitment. The initial training took about 3 hours to complete, while weekly 2-hour meetings occurred for a period from November 2013 to May 2014. At the end of the training participants again completed the attributional questionnaire.

3 Results

The first administration of the attribution questionnaire indicated a low internal attribution style. In fact, the average scores for success-commitment and failure-engagement were lower than those compared to the average Italian reference sample (1,280 children of school and high school and the first year of university). Participant scores were lower than the Italian sample –29.1% achieved lower scores on internal commitment to success and 38.7% lower scores on low internal attribution date commitment when unsuccessful.

Much importance has been given to the attribution for external causes (for example: the type of task, level of difficulty), in the experience situations of failure. The attributive profile obtained by averaging the results of the pre-test, without considering the commitment's role indicated that in order to improve an ineffective attributive style a Good Strategy User (GSU – Borkowski and Muthukrishna, 1994) style should be promoted.

The training progra was found to have a positive and statistically significant on the children. Considering commitment in the case of success and failure, a Wilcoxon signed-ranks test indicated that the main factors of attribution demonstrate a significant difference comparing pre-and post-test, i.e., success (pre-M = 24.46 vs. post-M = 32.92, Z = 3.34, p < 05) and failure (pre-M = 21.73 vs. post-M = 31.5, Z = 3.38, p < .05).

A Wilcoxon signed-ranks test revealed that scores for the success and failure task revealed that the first test obtained high values, particularly for the internal cause scale demonstrating the importance at the beginning of treatment, for failure, and this diminished significantly from pre to post treatment (M = 24.11 vs. M = 14.88, Z = 3.36, p < 05). The profile attributive obtained by averaging the scores of the 26 participants is

that of the GSU (good user of strategies) recognises the importance of commitment to the success of the school and knows that failure is due to a inadequate and/or insufficient study. Participants therefore moved from an external attributive style to a GSU style. From this it can be understood that participants effectively learned the connection between effort and achievement, and internalised those attribution strategies that enabled them to effectively deal with both successes and failures.

To be able to check changes in internal vs. external attributional style pre- and post-intervention participants were grouped into five types of assignment (commitment, skill, task, fortunately, help) and into two major categories: the internal (commitment, skills) and external attribution style (task, fortunately, help). The results demonstrated a significant difference between internal attribution styles for pre vs. post intervention. A Wilcoxon signed-ranks test indicated that the internal attribution was found to significantly increase – pre-$M = 19.69$ vs. post-$M = 26.54$, $Z = 3.3$, $p < 05$, while external attribution significantly decreased – pre-$M = 11.04$ vs. post-$M = 6.29$, $Z = 3.31$, $p < 05$).

5   Discussion and conclusions

The clinical significance of the effects of an intervention can be evaluated in several ways (Armbruster and Kazdin, 1994; Jacobson and Revenstorf, 1988; Jacobson and Truax, 1991). For example, after patients have completed the experimental treatment, the extent to which they fall within the normal range on relevant dependent measures can be examined. Alternatively, their diagnostic status can be re-evaluated to determine whether they continue to meet criteria for the disorder for which they sought treatment.

The results indicate the importance and effectiveness of a metacognitive-attributive intervention in favour of young people with oncological disease. Developing the interest, motivation and the will can empower seriously ill children in the positive self-attribution; focusing on the commitment develops a sense of responsibility and it facilitates a better adaptation to the management of the illness-related problems and may chances of success in schools.

The proposed project owes its success to the merger of two basic elements: the metacognitive approach-attributive and the ICT-centred methodology employed. The information and communications technology have enabled us to reach the kids with cancer who have to stay for a long time in hospital or care home. The statistically significant improvement obtained in the style of attribution with high scores in the internal attribution, the strong involvement of the participants and the interest shown by all the boys and their families have led us to consider whether to extend the methodology tested to more children with oncological diseases also in order to stimulate research in an area still too little studied.

Future research should focus on longer duration of cognitive training with more emphasis on metacognitive strategies and a better understanding of the long-term effects of the intervention. Longer training durations may be necessary to ensure adequate transfer effects. In addition, an emphasis on metacognitive strategies may help improve transfer to real-world behaviours. Larger studies should ideally include extended post-intervention follow-up assessments to examine the stability of intervention effects after training has ceased. Larger samples also would allow for analyses of variables that might help predict individual differences in response to cognitive training.

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