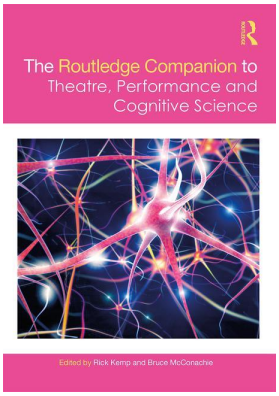

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A THEATRICAL INTERVENTION TO LOWER THE RISK OF ALZHEIMER'S AND OTHER FORMS OF DEMENTIA

Tony Noice and Helga Noice

This chapter describes a theatre intervention that uses professional acting instruction to lower risk factors for Alzheimer's disease and other forms of dementia. Please note that this is not a form of drama therapy, which treats those already afflicted, but is a preventive programme designed to help older adults remain cognitively healthy. The intervention has been supported by four multi-year grants from the National Institutes of Health as well as a number of private funders. The rationale behind this programme is that the practice of acting offers intense mental stimulation because it requires participants to retain theatrical dialogue verbatim without deliberate memorisation, and to perform dramatic scenes *truthfully* in front of an audience of their peers. This latter aspect of acting has been variously referred to as the 'reality of doing,' 'being in the moment' and 'living truthfully under imaginary circumstances,' and is a process that lies at the heart of professional acting. This chapter presents evidence that this approach to performance confers unique cognitive benefits to older non-actors, including increases in episodic memory, list recall, creativity and problem-solving ability, as measured by reliable and valid scientific assessment instruments. The programme has been carried out successfully for over 20 years in dozens of independent-living retirement homes and community senior centres in the USA.

Recently, the authors of this chapter were commissioned to review all existing studies on participatory arts programmes designed to enhance healthy ageing (Noice, Noice, & Kramer, 2014). We examined programmes on acting, dancing, writing, music (vocal and instrumental) and various visual arts (sculpting, painting, collage, etc.). Although we set no chronological limits for the search, we found only 31 extant studies that met our criterion of publication in peer-reviewed professional journals. Of those, fewer than a dozen were rigorous, pre-post studies with random assignment to condition. The latter group included reports on our own 20-year acting programme designed to lower risk factors for Alzheimer's and other forms of dementia. Prior to that, we were *expertise* researchers examining the cognitive processes of professional actors (e.g., Noice & Noice, 1993, 1994, 1996, 1997a). It was in the late 90s that we started to explore the value of acting instruction to enhance healthy cognitive/affective ageing. We still return occasionally to theoretical inquiry (e.g., Noice & Noice, 2007).

Our programme for older adults started with a chance meeting at a memory conference with two prominent Swiss cognitive and developmental researchers, Walter and Pasqualina Perrig

(like us, a husband and wife team). We mentioned our finding that college-age student-actors exhibited superior memory for text compared to controls (Noice & Noice, 1997b) and speculated that perhaps older adults might also benefit from studying actors' techniques. The next day over breakfast, the Perrigs asked if we would be interested in coming to Switzerland to pilot test our approach. We acquiesced within seconds, and the Perrigs asked us to generate a brief grant proposal, which was approved in short order by the Schweizer Nationalfond (the Swiss equivalent of the US National Science Foundation). The Perrigs were in the middle of a longitudinal memory inquiry assessing the effectiveness of various interventions for older adults. They asked us to devise and administer a short course in acting as a component of their multi-year study, using the recall and recognition measures they employed for the entire series.

Before going into detail on this and our subsequent healthy ageing experiments, we'd like to sketch in the background of this type of research. The early phase involved specific training programmes such as teaching older adults mnemonic techniques. For example, Robertson-Tchabo, Hausman and Arenberg (1976) found gains of 79% in list-learning ability after five days of instruction using the method of loci. This is a memorisation technique in which words are converted into mental images and then associated with specific areas of a familiar location such as one's home. However, in a later meta-analysis, Verhaeghen, Marcoen and Goossens (1992) concluded that the benefits of such mnemonic instruction do not transfer to other types of cognitive tasks.

The most extensive study investigating techniques to enhance healthy cognitive performance, Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE), employed randomised controlled trials, with 2,802 participants in a total of six US cities (Ball et al., 2002). The study produced evidence for the efficacy of three types of cognitive training: verbal memory, speed of processing and inductive reasoning. However, the results revealed two limitations: the training did not transfer (i.e., those trained on reasoning improved in that aspect of cognition but not on speed of processing or memory) and, despite the targeted gains, no increases were found on performance of activities of daily living. A follow-up study more than ten years later (Rebok et al., 2014) showed that some of the gains in speed of processing had been maintained (especially after booster training) but that the other original gains (memory and reasoning) had not.

Another widely used approach to investigating cognitive enhancement techniques consisted of correlating such activities with markers of healthy cognitive ageing (for a review, see Hertzog et al., 2009; see also, Verghese et al., 2006). However, as all beginning psychology students know, correlation is not causation, and experimental interventions under controlled conditions are necessary to persuasively document gains. One encouraging one (Kattenstroth et al., 2013) employed 35 participants, randomly assigned to either a dance condition or a usual activities (control) condition. Half of them learnt a complex choreographed dance over a six-month period; the other half continued with their usual activities. (None of the participants had engaged in dancing or physically effortful sports for at least five years before the experiment.) Both groups were pre-post-tested on cognitive and physiological measures such as Raven's Standard Progressive Matrices. At the end of the six months, the experimental (dance) group demonstrated significant cognitive and physiological improvements compared to controls. Unfortunately, many older adults cannot or will not engage in such rigorous physical activity for six straight months. Therefore, there appears to be a strong need for a non-strenuous, cognitively stimulating activity, preferably one whose benefits have been validated over a number of studies. A search of the literature revealed that our theatre programme appears to be the only series of studies systematically tested with the so-called gold standard of such assessment: *randomized controlled trials*, (e.g., Noice, Noice, & Staines, 2004).

A common assumption is that an acting programme would emphasise script memorisation, but our programme specifically directs participants to avoid intentional memorisation and to concentrate on understanding the scripted events in depth. This mirrors the procedure followed by most of the professional actors we employed in our early expertise studies.

The nature of acting expertise

Although rote repetition is widely assumed to be the strategy of choice for word-for-word retention, we found that our sample of professional actors rarely acquired dialogue by rote. One actor specifically addressed this:

> Most of the time I memorize by magic – and that is, I don't really memorize. There is no effort involved. There seems to be no process involved: It just happens. One day early on, I know the lines.
>
> *(Noice, 1992, 420)*

A number of experiments using both protocol analysis and empirical methodology revealed that actors (apparently unwittingly) employ most of the learning principles identified by an earlier generation of cognitive researchers (Noice & Noice, 1997a). Actors engage in extensive elaboration, perspective-taking, self-referencing, self-generation, mood congruency, distinctiveness and so forth. They also determine the goal of every utterance of the character, breaking down scripts into what they call 'beats' (small goal-directed chunks of dialogue). These beats lay out the entire role as a causal chain, a process that often entails generating multiple elaborations for a few words of dialogue. (A well-established cognitive concept is that both causal chaining and additional elaboration lead to greater recall, e.g., Graesser & Clark, 1985.)

However, our research showed that retention of the textual material is only the preparatory part of the actor's work. The actor must then *mean* the words of the script each time he or she says them so that every performance is unique even though the words are unchanged. That is, *how* the words are said depends on the spontaneous mental-physical-emotional interactions between the actors at every moment of the performance. This double process appears to be in general use by professionals; they analyse the role prior to rehearsal, but during rehearsal, they try to devote all their conscious awareness to remaining in the present moment by attending to the other actors, only glancing down at the script when necessary. Eventually, they find they are *off book* and *performance-ready.*

A vexing question not answered by the specification of actors' script-processing approaches was whether their rapid acquisition of dialogue was a product of their expertise (acquired by long practice) or was based on an explicit strategy that could be taught to non-actors. To answer this, the authors tried to train undergraduates in the actors' strategy (Noice & Noice, 1997b). At first, we assumed that the preliminary part of the learning strategy (the deep processing of the script) was responsible for an actor's highly efficient memory. Therefore, we taught students to elaborate on a text by asking goal-directed questions (e.g., 'Am I flirting with her when I say this?'). Consistent with previous findings, students who elaborated by questioning the underlying meaning remembered more than controls who read the same text purely for comprehension. (Indeed, most of the early investigations of cognitive learning principles had employed *read-only* controls.) However, we then tried to make the conditions more stringent by having the controls deliberately memorise the same material. If the actors' strategy still produced more retention, it would suggest the existence of an optimal means of studying verbal material. Unfortunately for our hypothesis, the deliberate memorisation

controls outperformed the students who used the actors' analytic strategy (M = 57% for memorisation strategy vs. M = 33% for actors' analytic strategy, Noice & Noice, 1997b). Putting aside our original assumption, we turned to the other half of the actors' process, the one they use for rehearsal and performance. Instead of instructing the students to analyse the text, they were told to read the material, imagining someone they knew who needed this information. Indeed, we specifically told them *not* to try to remember the words but to put all their concentration on meaning them. Suddenly, the results were reversed—meaning the words produced greater retention than memorising them (M = 50% for memorisation strategy vs. M = 60% for actors' performance strategy). We have been able to replicate this finding using different populations, procedures and materials other than dramatic dialogue (e.g., newspaper articles). In writing up the results for publication in the cognitive literature, we coined the term *active experiencing* (AE) to refer to this process in which participants are asked to refrain from deliberate memorisation but to use all physical, mental and emotional channels to communicate the meaning of material to another person, either actually present or imagined (for a review, see Noice & Noice, 2004). This process of trying to 'live' the material rather than just memorise it appeared to make a major difference in the results.

This brief summary of some of our early studies brings us back to the chance meeting with Pasqualina and Walter Perrig, described at the beginning of this chapter. They were in the midst of a longitudinal experiment to determine what factors might boost recall and recognition performance in a group of retired office and executive employees of a large chemical corporation in Basle, Switzerland. When the results of all their interventions over the years (vitamin regimes, weight training, etc.) were analysed, the acting programme was one of the few that produced statistically significant increases on their assessment measures (Noice et al., 1999). The results of this pilot study reinforced our notion that acting instruction might provide sufficient mental stimulation to enhance various cognitive abilities. Therefore, in future experiments, we would not be restricted to showing increased retention and recognition of theatrical dialogue but might see enhancement of a number of general cognitive abilities (creativity, episodic memory, prose comprehension, problem-solving, etc.).

Experimental procedure used across our various studies

To supply evidence of effectiveness, the experimental group receives our four-week acting class, one of the control groups receives an alternate course of instruction (e.g., visual or performing arts) and the second control group continues with their usual daily activities (no-treatment condition). The experimental group and the active controls meet for two 70-minute sessions (60 minutes of training and 10 minutes for a break to allow for socialising) each week for four weeks. All three groups are simultaneously pre-tested the day before classes start and post-tested on the day following the final class sessions. An important feature of the testing is that none of the assessment instruments are targeted to the training but simply test abilities necessary or helpful for independent living. This procedure is relatively rare. In many cognitive interventions, the instruction is specifically targeted, such as training in the method of loci and testing the result with a list-learning task, teaching of test-taking strategies or practice runs on tasks similar to those on the pre-post tests. Because we did not engage in any such tactics, the improvements following our acting classes would appear to be the result of the intense activation experienced by imaginatively becoming immersed in a fictional situation and performing it in front of the group. To minimise attrition, all participants receive a small gift of $40.00 at the end of the course, but only if they attend every session, including the pre- and post-tests.

In sum, our theatre classes are based on a widely accepted notion that good acting consists of *spontaneous* and *truthful* performance.[1] Therefore, if the scene calls for Character A to plead with Character B, then Actor A pleads with Actor B. The actor does not *pretend* to plead or try to duplicate the external behaviour of someone engaged in pleading; he or she simply pleads with the other actor *for real*. Although this duplicates what we do in our everyday lives, the constraints of playing a theatrical scene turn this into a highly complex cognitive task. In life, we make up our dialogue as we go along, depending on our needs of the moment, but the actor has already learnt and rehearsed the scene yet must render it spontaneously (*not* just apparently spontaneously) at the moment of utterance. Countless theatrical theorists have struggled with ways to truly live *moment to moment* while simultaneously retrieving the exact words and movements from memory. One well-known acting guru, Sanford Meisner, described it as 'living truthfully under imaginary circumstances' (Meisner & Longwell, 2008, 15). The majority of contemporary acting teachers would probably agree with this definition, but there such agreement would end. Meisner had his own approach to get his students to accomplish this tricky task. Many other highly regarded acting teachers and their disciples (e.g., Benedetti, 2008; Chekhov, 1993; Cohen, 2007; Hagen, 1973; Lewis, 1958; Strasberg, 1988) have their own original roadmaps to get students to engage in this truthful, spontaneous performance of well-learnt material. One rationale for our own eclectic intervention is that when non-actors attempt to engage in such professional techniques, the process is even more challenging (and hence, more stimulating) than when trained actors perform the same tasks.

Therefore, we embarked on a series of studies to find empirical evidence on the validity of our rationale. As usual with such a research programme, each study not only answered a specific research question but prompted additional ones that required additional experimentation. The first large, controlled intervention in the USA (Noice, Noice, & Staines, 2004) used 124 community-dwelling participants (aged 60–86) recruited from senior centres or retirement homes.

Overview of that first US intervention

Following the previously described experimental procedure, these participants were randomly divided into three groups: the experimental group (theatre), the group to control for non-content-specific effects (art appreciation) and the no-treatment control group. It should be noted that the art appreciation group was, however, very active. For example, in one session, participants arrived to find reproductions of various art works displayed on easels throughout the large training room. They were given tokens with bold titles such as 'I love it!' or 'Fine for a museum but not in my house!' or simply 'Yuck!' They had to post the tokens on the various art works and defend their choices during subsequent discussion with their peers.

As previously explained, the main experimental group (theatre) was given a beginning acting course, with each session emphasising genuine involvement in the dramatic situation. The instructor (a professional actor/director and professor of theatre) emphasised that he would be correcting people from time to time in order to illustrate common mistakes that are part of the process. However, to put the participants at ease, he emphasised that even highly experienced professional actors receive the same sort of corrections from directors. At each session, every participant did every exercise, with the rest of the group serving as an audience. The exercises became much longer and increasingly more complex, with new 'acting tools' frequently being added. In the beginning, the participants held the scripts during performance so that the emphasis was always on genuinely experiencing the essence of truthful acting and never on remembering the literal words. Thus, participants were trained to become cognitively,

emotionally and physiologically involved in dramatic situations by practicing a wide range of theatrical intentions such as 'To confront,' 'To apologize,' 'To demand attention' or 'To tease.' The goal throughout was to give participants the ability to become so engrossed in the character's inner life that obvious behavioural changes occurred without intentional manipulation. These changes included facial expressions, body language, tones of voice, affect states and so forth. It must be stressed again, although no intentional memorisation of dialogue was ever required, the repeated rehearsals of these short scenes resulted in retention of the exact words as a concomitant of making the strong mental effort necessary to genuinely affect their acting partner by *meaning what they were saying*, using all channels of communication.

Both before and after the intervention, all participants were pre-tested on three cognitive measures (recall, working memory, problem-solving), and two affective measures: self-esteem (Rosenberg, 1965) and a quality of life scale consisting of self-acceptance, positive relations and personal growth (Ryff, 1989; Ryff & Keyes, 1995). Results for the cognitive/affective measures showed that, compared to the no-treatment controls, the theatre group improved significantly on quality of life ($p = 0.002$), list recall ($p = 0.007$), problem-solving ($p = 0.015$) and barely missed significance on working memory ($p = 0.056$).[2] In general, although the visual art group made some gains, such gains were far weaker, both in number and degree. Because the no-treatment controls were given a courtesy course following the testing, they could no longer be used for comparison purposes. However, when the theatre group was retested in four months without reinstatement of the training, no declines were found in any of the measures.

Some open questions to be answered

The 2004 experiment left open the question of why the art appreciation group did not improve as dramatically as the theatre group. Perhaps the reason was the lack of public performance. Therefore, the authors designed an experiment to compare acting to an art form requiring such performance: singing (Noice & Noice, 2009). The crucial question was whether singing training would produce results comparable to acting training, or if the specific nature of acting was responsible for the observed gains. Indeed, the reason the singing group was employed this time was that our previous choice, art appreciation, was designed to rule out the notion that *any* stimulating course given in a social situation might produce these benefits. We considered using other performing arts as controls but chose singing because of its practicality; dancing would eliminate many potential participants due to physical requirements, and learning to play a musical instrument involved both a longer time commitment plus the availability of fairly expensive instruments. However, our voice teacher, in addition to being a soloist with the Chicago Symphony, had a great deal of experience training beginners and verified that noticeable vocal improvement can occur within four weeks. For this experiment, we expanded our test battery to include eight cognitive instruments, plus an affective instrument, a memory controllability index and an activity scale. All tests were individually administered, and were experimenter-timed or self-timed, as called for in the instructions for each particular test.[3] The rationale for the choice of the additional instruments was three-fold:

a Each ability tested was important for healthy, independent living,
b All instruments were valid, reliable and standard in the field, and previously observed declines in these measures had been shown to have implications for dementia (e.g., Bennett et al., 2006).
c The tests could be administered in less than 90 minutes to avoid fatiguing the participants or subjecting them to multiple test sessions.

Overall rationale of experiment

In this iteration of our theatre intervention, we predicted that the acting group would improve significantly relative to the singing and no-treatment groups, because our former research led us to believe that acting contains a unique combination of various elements found in a number of successful ageing studies. It is novel, effortful, enjoyable, multi-modal/multi-factorial and mentally and physically stimulating. It requires participants to truthfully and spontaneously react to fictional situations, an experience that is at the core of the acting process. Moreover, it is emotionally activating and it encourages bonding in a social situation. An ever-increasing body of evidence indicates that such social interaction correlates positively with healthy cognitive ageing. Litwin and Shiovitz-Ezra (2010) found that the more social ties older adults had, the greater the well-being and the less anxiety they experienced. We are not aware of any other type of leisure activity that encompasses all these elements in such concentrated form. Consequently, we expected to find significant increases in the test scores of the acting group relative to the singing and no-treatment groups.

Results

The results were positive as predicted, showing greater improvement for the acting group over both the singing group and the no-treatment group on immediate and delayed word recall, immediate and delayed story recall, means-end problem solving, verbal fluency and personal growth (all $p < 0.05$). An interesting finding emerged from the data. Even though the acting group outperformed the singing group on all the cognitive measures, the acting and singing groups did equally well on the affective measure, personal growth. This suggests that, even in the absence of any demonstrated cognitive enhancement, the singing group still felt better about their lives after training.

This new experiment was also designed to investigate many other open questions. Are the benefits of theatre training restricted to those relatively healthy older adults who still function well in their own homes (as in the two former experiments) or could seniors (primarily low-income seniors) living in retirement homes make similar gains? Would participants almost a full decade older than those in the former study benefit? Would physical problems that inhibited mobility lessen or eliminate the positive effects? Would the fact that the majority of the current participants were less well educated affect the benefits? Our data showed that participants in the acting group prevailed over all these possible roadblocks.

Another question answered

As usual, still other important issues had to be addressed by future experimentation. Up to this point, all iterations of the theatre intervention had been carried out by the same professional actor, director and professor of theatre who devised the performance aspects of the programme. Perhaps the results were due to the specific qualities of this one individual acting teacher. Therefore, in the next study (Noice & Noice, 2013), retirement home activity directors without any background or experience in theatre were taught to administer the programme. Along with personal instruction, the activity directors attended a complete intervention given by the original instructor and took notes.

Yet another question was answered by this two-part study. In addition to the activity directors, one newly recruited professional actor/director/acting teacher was also engaged to administer the same intervention. However, she received only minimal instruction (mainly e-mailed descriptions of the training and short follow-up phone conversations before

each session). If this new instructor produced pre-post results similar to those produced by the originator of the intervention, that finding would suggest that other qualified acting teachers could successfully duplicate the programme throughout the country.

Since the design necessitated two types of instructors, it obviously required two interventions, one conducted by activity directors and the other by the outside professional. With this one exception, the programme remained the same (i.e., number and length of sessions, content of the acting intervention, payment of participants, the cognitive/affective test battery). However, we added one functional test for both the activity directors and the professional instructor: The Observed Tasks of Daily Living, Revised (Diehl et al., 2005). This complex instrument contains 28 tasks, and uses actual objects such as prescription bottles, utility directories and check registers. Participants are required to perform such tasks as comparing prescription ingredient labels, paying bills and looking up and dialing telephone numbers. Three areas of functioning are examined: medical matters, telephone use and handling finances. This test in its original form was designed for the ACTIVE experiment (Ball et al., 2002), but, thanks to the creators' generosity, the revised version was released to the wider community of researchers a few years later.

The results of Experiment 1 (activity directors) showed that a few significant gains could be achieved when the intervention is conducted by persons without formal theatre training. However, the size and variety of those gains are certainly not comparable to those achieved by the professional (immediate word recall, verbal fluency and problem solving $p > 0.01$, East Boston Memory Test, $p = 0.007$). Our demographic analysis in Experiment 1 produced one quite atypical result: amount of education was not correlated with the observed gains. This unusual finding suggests that, unlike other training or correlation studies (e.g., Tun & Lachman, 2008; van Hooren et al., 2007), improvements from this programme may be independent of prior education provided the differences are not too great. (In our current research, using a very highly educated sample that included many PhDs, the usual education advantage was observed.)

Of course, researchers have examined a variety of other approaches for enhancing healthy cognitive ageing. For example, Basak et al. (2008) investigated commercially produced computer games and found improved executive function in participants who played for 23.5 hours; other positive results were found by Smith et al. (2009) and Nouchi et al. (2012). However, as pointed out in a review article on technologically delivered cognitive improvement programmes, 'objective evidence that a particular game or computer intervention can improve an individual's quality of life outside of the laboratory is sparse' (Charness & Boot, 2009, 256). Moreover, such games are obviously solitary undertakings and lack the strong benefits associated with social interactions described earlier.

Another advantage of our intervention is that written instructions and scripts are left in the libraries of the retirement homes. Some administrators have already reported integrating theatrical activities into their regularly scheduled programmes. As of this writing, in one facility, six productions, complete with costumes and sets made by the residents, have already been staged. Furthermore, in the majority of the retirement homes, some intervention participants performed scenes or sketches in the facility's subsequent talent shows. Thus, this programme sets up the possibility of cognitively enhancing lifelong learning for some of the older adults who partake in it.

The search for empirical evidence of benefits continues. We have recently concluded a four-year study using fMRI brain scans and electronically delivered cognitive tests to document any pre-post intervention gains. The control group received a wide-ranging course about theatre that did not include any acting instruction. In this way we tried to rule out the

possibility that any previously observed behavioural advantages were due to the inherent appeal of theatre itself rather than the intense mental activity involved in learning and applying acting techniques. The data are still being analysed, but at least one important positive result has emerged: a significant increase in episodic memory (Banducci et al., 2017). This is an important finding because prior research has shown that a decline in episodic memory is one of the first and most salient signs of incipient Alzheimer's disease (e.g., Bennett et al., 2006; Wilson & Bennett, 2003).

We would like to conclude this chapter with a brief summary of the advantages of acting classes and their unique place in the small group of healthy ageing interventions not requiring intense physical activity. The efficacy of acting classes has been demonstrated by multiple investigations that were supported by major government organisations (e.g., National Institute of Aging). The acting intervention involves a very high degree of social interaction, shown to be an important factor in healthy ageing (e.g., Litwin & Shiovitz-Ezra, 2010). It is *novel* for all the participants (no former amateur or professional actor is eligible to participate in our studies), and novelty is another prime ingredient shown to enhance healthy ageing (e.g., Hultsch et al., 1999). Furthermore, acting is generally fulfilling and enjoyable, thus encouraging future involvement; in fact, in all our studies, the attrition rate for the theatre groups was, more often than not, *zero*, compared to fairly frequent dropouts in the control groups. (Control group attrition was of course analysed and accounted for in the statistical reports.) Additionally, the theatre intervention is brief and relatively low-cost, requiring only one teacher and no expensive equipment. Finally, we hope the experiments discussed here encourage further inquiry into theatre and other participatory arts by many additional investigators. There is a great need for this type of leisure activity for older adults. We certainly recognise the demonstrated value of the exercise and dance programmes, but for those unwilling to push the limits of their perceived physical stamina, we still believe 'The play's the thing.'

Notes

1 The emphasis on truth and spontaneity during the performance of a fictional situation comes from the teachings of Stanislavski (for an up-to-date, one-volume translation of these teachings, see Stanislavski (2008). As of today, the dominant approach in the majority of college acting programmes is still Stanislavski-based, with many, many individual variations. This is true of our own approach, both in the older adult programme and at Elmhurst College. We acknowledge that still other approaches (some, but certainly not all, integrating Stanislavski-like components) are taught in secondary and post-secondary education. These include the approaches of Lecoq, Grotowski, Brecht, Meyerhold and others. Followers of these later theorists testify to the efficacy of their techniques. Nevertheless, we opted to base our own eclectic intervention on the acting principles most frequently taught in the USA.

2 For readers unacquainted with this statistical reporting convention, the p value indicates the number of times (out of 100) that the finding might have occurred by chance. Thus a p value of 0.05 means that, if the experiment were performed 100 times, in 95 of those trials, the result would have been due to manipulation (in our case, participating in the acting course). The other five times might be due to coincidence. In general, a p value of 0.05 or below is considered 'statistically significant' and can be relied upon. Some of our measures scored as low as 0.001, indicating that, 999 of 1000 times, improvements following the acting course could not have been due to chance.

3 For those interested in the details of specific tests, see the Reference section under the following names: Morris et al. (1989), Wechsler (1987), Albert et al. (1991), Platt and Spivack (1975), Ryff (1989), Ryff and Keys (1995), Lachman et al. (1995), Wilson et al. (2002).

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