

REVIEW

Beyond the crossroads of magic, health, and well-being

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ABSTRACT

Magicians and scientists have begun collaborating to gain insight into various psychological functions. However, one underexplored area is the use of magic tricks to enhance health and well-being. Several magic programmes currently use magic tricks to enhance cognitive, emotional, social, and physical well-being. The applications of these magic programmes range from physical and psychological therapies to gang prevention, hospitals and classrooms. A few programmes have been empirically investigated and there is now a growing number of empirical studies that explore the well-being value of magic. Therefore, we conducted an up-to-date summary

review of magic, health, and well-being. These studies are reviewed in light of a proposed hierarchical model based on how the magic was applied. Overall, methodologies could be improved but distinctions between levels of the hierarchy are observed and discussed. Furthermore, the positive effects on well-being can also be organized into interrelated physical, cognitive, social, and affective components that reflect existing theoretical frameworks on well-being. To conclude, we discuss possible mechanisms and theoretical frameworks based on more established psychological theories to help guide future research.

Keywords: AWE, CURIOSITY, MAGIC, SOCIAL SKILLS, WONDER

INTRODUCTION

For thousands of years magicians have been learning how to accomplish the impossible, and sharing moments of wonder with their audiences, as they continue to do so today. More recently, magicians and scientists have joined forces and are now developing a science of magic (1-3). This approach has predominantly focused on magicians' deceptive methods that explore a wide range of psychological functions (1, 4, 5). However, magic may also offer valuable tools to enhance health and well-being in many areas. While several established programmes already use magic to enhance both mental and physical well-being, much of this has been poorly documented and few connections have been made across different approaches. Therefore, this paper aims to provide an up-to-date review of approaches that use magic to improve well-being and examine them in light of available empirical research. We also provide a progressive hierarchy that organizes current research and programmes (6). While there are likely similarities with recent advances in other arts and well-being research (7), we hope this hierarchy will be particularly helpful as a framework for future research on understanding magic-based approaches to well-being and clarifying the most befitting applications,

and perhaps other arts, since magical expertise draws upon a broad spectrum of domains.

To understand the relationship between magic and well-being, it is worth looking at the magical experience. Magic deals with fundamental psychological principles such as consciousness, belief, and free will (1, 2, 4, 5), yet the experience remains poorly understood. However, interdisciplinary endeavours have started uncovering certain key factors. Analyses from magicians (8), philosophers (9), historians (10), psychologists (2, 3, 11) and neuroscientists (12) all highlight one common explanation: magic elicits a conflict between what we believe to have experienced and what we believe to be possible. This experience mirrors both Harris's (13) work on children's reactions to causal violations and Berlyne's (14) distinction between epistemic curiosity and perceptual curiosity. The curiosity that naturally arises from this dissonance is particularly relevant to affective and cognitive domains of well-being. Others have described the affective components as a particular type of wonder (2, 10), as curiosity stimulated by surprise (11, 12), and as pleasant, humorous, and highly memorable due to that intense curiosity (9). Therefore, since knowledge-seeking positive emotions such as curiosity are present, watching magic tricks may enhance well-being via cognitive and affective domains. Moreover, the socially

interactive nature of magic may prove useful in social domains of well-being. We will first shed light on the applied approaches before discussing empirical studies and theoretical frameworks.

MAGIC PROGRAMMES FOCUSED ON WELL-BEING

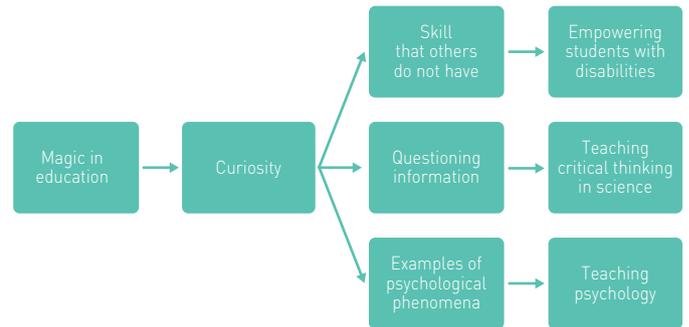
Many magic-based well-being programmes are implemented throughout health care. Open Heart Magic applies magic to hospital environments (15) to deliver humour for its healing benefits, and the interactive nature helps with practical aspects. Another programme is MagicAid (16, 17), which trains medical students to deliver magic therapy in paediatric hospitals. Academics have described how this interactive component could inform medical practitioners about building rapport (18), gaining trust, enhancing likeability, and becoming aware of non-verbal signals affecting patient decisions (19).

In rehabilitation, programmes commonly employ magic in physical and occupational therapy. Rehabracadabra delivers such workshops to occupational therapists (20). Healing of Magic is an American Occupational Therapy Association-approved programme that teaches therapists tricks to use in their practice (21, 22), and Copperfield's Project Magic also uses magic tricks as rehabilitative tools (23). Lastly, the Breathe Magic programme motivates children with neuromuscular conditions to engage in intensive physical therapy by teaching them magic (24). Rather than solely training therapists, however, Breathe Magic utilizes magicians who work alongside therapists and researchers to incorporate effective therapeutic movements directly into the magic.

Magic has also been combined with psychological therapies. Within prison rehabilitation, magic and cognitive behavioural therapy has been used to help disengaged prisoners actively participate in therapy (25). Other combinations of magic with psychological therapy include school counselling (26) and child psychotherapy (27).

In the corporate space, Hashtag Positivity offers assessments, online courses, and resilience coaching that combine magic and workshops to deliver customized empowering messages (28). Similarly, Abracademy offers corporate programmes, such as resilience workshops (29), that integrate evidence-based exercises and positive psychology models with a magic-themed workshop.

FIG. 1. RATIONALES AND APPLICATIONS OF USING MAGIC TRICKS IN EDUCATION



Magic has also been found useful for gang and crime prevention in charities such as Blood Brothers Magic, Streets of Growth, and a Magicians Without Borders programme at the College of Magic (30-34). While magic is not the only tool used, the rationale for magic in street work is that individuals who are easily lured towards destructive lifestyles are also attracted to magic because both can involve “showing off” and gaining credibility in a group through deception. Thus, street magic can offer a valuable tool to connect with at-risk youth and bring long-term relationships that lead to promising futures.

Lastly, magic and well-being is applied in schools (see Fig. 1), especially with respect to students with a disability. Hocus Focus is a curriculum designed to motivate students with learning difficulties by using magic tricks, which teachers incorporate into their lessons. The programme explains that the magic stimulates curiosity and enhances self-esteem by giving students skills that their peers without disability cannot perform (35), which mirrors Frith and Walker's (36) rationale for teaching magic to empower students with a disability. Others also suggest that magic would be useful for teaching science (37) and psychology (38, 39) to students in general.

OVERVIEW OF EMPIRICAL STUDIES

Even though several active programmes use magic to enhance well-being, only a few have been empirically evaluated (40-43) and few connections between the varied approaches have been made. To date, only a few reviews exist (44, 45) and they lack a meaningful and theoretical framework to organize the various ways in which magic is applied, which is essential for guiding, developing, and designing practical use cases. The only exception is the framework proposed by Bagiński and Kuhn (46). As outlined in Fig. 2, this framework builds progressively, with each level acting as a foundation for the

next. This suggests that benefits of a magic programme may build upon each other. For example, if watching magic elicits curiosity, then this curiosity will transfer to learning how to perform magic (at least initially) because one must see the magic before learning it. Furthermore, that initial curiosity may play a powerful role in motivating people to learn how to perform magic, or in shifting that interest to another relevant topic. Using this framework, we conducted an up-to-date summary review of magic, health, and well-being, which yielded the empirical studies summarized in tables (see table 1, table 2, table 3, table 4, table 5).

DISCUSSION

As discussed elsewhere in detail (46), applications of magic to enhance well-being in physical, affective, cognitive, and social domains are evident throughout both active programmes and emerging empirical studies. These domains reflect physical health outcomes in addition to the elements of well-being from Seligman's (85) well-being theory, namely, Positive Emotion, Engagement, Relationships, Meaning and Accomplishment (PERMA). Based on the available (albeit limited) empirical studies, we provide support for a hierarchical model of magic and well-being that progresses from watching magic to teaching with magic. This model reveals unique benefits emerging at each stage, with at least some retained when moving up the hierarchy, as outlined in Fig. 3.

From a theoretical perspective, it is important to clarify that this hierarchy can certainly be more nuanced. One such nuance is whether curiosity stems from watching the actual performance or anticipating the magic, such as wondering what someone means by magic or wondering what tricks, stories, and surprises are about to unfold. Other nuances include the difference between figuring out secrets versus being told the secrets, and the impact of practicing magic tricks versus the impact of performing magic. Lastly, there is likely a broad range of meaningful applications for performances that affect the performer, and it would be placed along the stage of "teaching with magic" in the hierarchy. While it is certainly applicable to future experiments, the proposed hierarchy excludes these nuances because it is based solely on the currently available empirical studies.

In the first stage of witnessing magic, positive emotions and engagement from PERMA are exhibited as curiosity, interest, and its application is in distraction therapies. For example, participants in Subbotsky's experiments (66) exhibited

FIG. 2. PROGRESSIVE HIERARCHY STAGES FOR WELL-BEING EFFECTS OF MAGIC



curiosity in response to magic tricks while a different study used curiosity from magic to decrease preoperative anxiety (67). In the next stage, positive emotions and accomplishment were observed as happiness (stemming from pride) and tension release from discovering secrets by repeatedly watching magic tricks until they figure them out (70). Additional improvements in social and motor skills only emerged once participants reached the stage of performing magic, which reflects relationships (and perhaps more accomplishment) in the PERMA framework (85). One distinction between stages is that the use of magic as a curiosity-inspired distraction tool helps manage children with inflated self-esteem, whereas learning to perform magic helps uplift children with low self-esteem. Only two studies investigated the effects of teaching with magic, and they indicated that the only distinct benefit from prior stages was a deeper appreciation for teaching, which may reflect meaning in the PERMA framework (85) because teachers noticed the positive impact it had on their students.

These observations are not surprising given that well-being outcomes from PERMA elements are often correlated (86). We do, however, hypothesize that magic is particularly unique and useful due to 1) the high degree of curiosity it inspires, partly due to its obscure nature, and 2) its frequent reliance on both astute social skills (87) and a broad spectrum of motor skills. However, further research is required since many studies lack scientific rigour, do not control for a third variable (for example, humour or learning a new skill), and few investigate specific mechanisms.

Additionally, it is not clear whether certain benefits are more applicable to certain samples. For example, many samples involve children or people with a disability. However, some well controlled studies indicate that inspiring curiosity (66) and using magic for distraction therapy (47, 50, 67, 77) are common in both healthy children and well functioning

TABLE 1. SUMMARY OF STUDIES WITH IMPLICATIONS FOR IMPROVED PHYSICAL HEALTH USING MAGIC, ACROSS LEVELS OF THE MAGIC AND WELL-BEING HIERARCHY

Reference	Sample size and type	Measures	Results with effect sizes (if applicable)
Witnessing magic			
Labrocca and Piacentini (47)	<i>n</i> = 100 three-to-twelve-year-olds	Oucher scale (48) to categorize if they felt venipuncture pain	Perceived less pain from shots when distracted by magic (<i>P</i> = 0.016, * ϕ = 0.261)
Lustig (49)	<i>n</i> = 266 self-selected students	5-point Likert scale assessing AIDS knowledge and self-efficacy in prevention behaviours before and after the magic show	AIDS knowledge increased on questions about: Mosquitoes (<i>P</i> < 0.001, * <i>d</i> = 0.383) Donating blood (<i>P</i> = 0.005, * <i>d</i> = 0.319) Looking sick (<i>P</i> = 0.007, * <i>d</i> = 0.304) Latex condoms (<i>P</i> < 0.001, * <i>d</i> = 0.319) Self-efficacy increased on questions about students' ability to: Refuse sex (<i>P</i> = 0.003, * <i>d</i> = 0.340) Buy condoms (<i>P</i> = 0.524, n.s.) Put on condoms (<i>P</i> < 0.001, * <i>d</i> = 0.319) Take off condoms (<i>P</i> = 0.446, n.s.)
Peretz and Gluck (50)	<i>n</i> = 70 three-to-six-year-olds with strong-willed behaviour	Time to dental chair Ability to take dental radiographs	Magic group took less time to enter the dental chair (<i>P</i> = 0.001, * <i>d</i> = 0.864) Magic group had more radiographs taken (<i>P</i> = 0.0013, * ϕ = 0.261)
Discovering magic secrets			
None			
Performing magic			
Green et al. (40)	<i>n</i> = 22 hemiplegic children	Assisting Hand Assessment (51) Children's Hand Experience Questionnaire (52)	Improved hand use as per scores on: Assisting Hand Assessment (AHA) <i>P</i> = 0.002, η^2 = .48 Children's Hand-use Experience Questionnaire (CHEQ) (<i>P</i> < 0.001, η^2 = .58)
Kwong and Cullen (53)	<i>n</i> = 5	EuroQol EQ-5D Health Questionnaire (54) Rosenberg Self-Esteem Scale (55) RAND 36-Item Short-Form Health Survey (56)	Sample too small for statistical analysis, but patients' energy/fatigue levels appeared to increase (<i>P</i> = 0.02, * <i>d</i> = 1.436)

TABLE 1. SUMMARY OF STUDIES WITH IMPLICATIONS FOR IMPROVED PHYSICAL HEALTH USING MAGIC, ACROSS LEVELS OF THE MAGIC AND WELL-BEING HIERARCHY

Reference	Sample size and type	Measures	Results with effect sizes (if applicable)
Schertz et al. (57)	<i>n</i> = 20 children with unilateral cerebral palsy with measures before, after, and at 8–10-week follow-up	Radiological scores Functional Magnetic Resonance Imaging (fMRI) Diffusion tensor imaging (DTI) Assisting Hand Assessment (AHA) (51) Children's Hand-use Experience Questionnaire (CHEQ) (52) Jebsen-Taylor Test of Hand Function (JTTHF) (58)	Neurological changes in the children's brains as a result of the magic camps: Positive correlation between radiological scores and both AHA ($r = 0.48, P < 0.05$) and CHEQ ($r = 0.63, P < 0.05$) Negative correlation between radiological scores and JTTHF ($r = -0.51, P < 0.02$) fMRI correlations: Negative correlation between ipsilesional hemisphere activation and AHA progress ($r = -0.61, P < 0.01$) at post-measure only Negative correlation between contralesional hemisphere and AHA at post-measure ($r = -0.56, P < 0.05$) and follow-up ($r = -0.48, P = 0.052$) DTI correlations: Negative correlations between AHA and fractional anisotropy in both affected ($r = -0.6, P < 0.05$) and less affected ($r = -0.50, P < 0.05$) corticospinal tracts at follow-up Negative correlation between CHEQ and fractional anisotropy in posterior limb of internal capsule at post-measure ($r = -0.55, P < 0.01$) and follow-up ($r = -0.66, P < 0.01$) Improved hand use in children: AHA ($P < 0.05, \eta^2 = .166$) CHEQ ($P < 0.001, \eta^2 = .483$) JTTHF ($P = 0.001, \eta^2 = .388$)
Sui and Sui (42)	<i>n</i> = 40 schizophrenia and depression patients	Purdue Pegboard Test (59)	Improved motor skills from Purdue Pegboard Test: Left hand ($P < 0.05, *d = 0.198$) Right hand ($P < 0.05, *d = 0.142$) Both hands ($P < 0.05, *d = 0.604$)
Weinstein et al. (60)	<i>n</i> = 12 children with hemiparesis with measure taken before, after, and at six-week follow-up	Magnetic Resonance (MR) imaging fMRI imaging Assisting Hand Assessment (AHA) (51) Children's Hand-use Experience Questionnaire (CHEQ) (52) Jebsen-Taylor Test of Hand Function (JTTHF) (58)	Neurological changes in the children's brains as a result of the magic camps: 26% increase in β values of affected hemisphere ($n = 7$), 35% at follow-up ($n = 4$) 4 of 12 showed improvements in lateralization index, maintained at follow-up 7 children showed increased diffusivity values after intervention, 3 had increased diffusivity in affected hemisphere Improved hand use of hemiplegic hand: 7 of 12 improved significantly on AHA, with 3 maintained at follow-up 6 of 12 improved on CHEQ, and 3 maintained at follow-up 8 of 12 improved on JTTHF and 4 of 4 maintained at follow-up
Teaching with magic			
None			

NOTE: For Lustig (1994), no standard deviations were reported, so effect size was calculated using degrees of freedom and t-statistic. An estimate of the t-statistic was obtained by using the quantile function in R statistical software. Where effect sizes were not reported, we have manually calculated effect size from given data, where possible. Non-significance at 95% confidence level is indicated by "n.s."

TABLE 2. SUMMARY OF STUDIES WITH IMPLICATIONS FOR IMPROVED SOCIAL WELL-BEING FROM MAGIC, ACROSS LEVELS OF THE MAGIC AND WELL-BEING HIERARCHY

Reference	Sample size and type	Measures	Results with effect sizes (if applicable)
Witnessing magic			
None			
Discovering magic secrets			
None			
Performing magic			
Lyons and Menolotto (61)	<i>n</i> = 6	Response frequencies on 7-point scale after the intervention only	Five of six participants rated magic as “sociable”
Spencer (41)*	<i>n</i> = 32 to 44 students	Qualitative data from teacher observations and student journals	Three themes were: 1) improved leadership and socialization skills, 2) positive peer relationships, peer mentoring, and collaboration, and 3) rapport building between student and teacher
Sui and Sui (42)	<i>n</i> = 40 schizophrenia and depression patients	Personal Well-being Index (62)	Overall score in Personal Well-being Index increased ($P < 0.05$, $*d = 0.370$), which was driven by the questions about 1) interpersonal relationships ($P < 0.05$, $*d = 0.482$), and 2) society integration ($P < 0.05$, $*d = 0.554$)
Spencer and Balmer (63)	<i>n</i> = 21	Frequency of conversations initiated (number of tallies per time of observation period)	Students initiated more conversations in English after the magic programme (88.7% data points were above the highest baseline data point)
Teaching with magic			
Papalaskari et al. (64)	Adolescent magic “scholars” teaching magic to younger kids	Qualitative measures from focus groups and exit surveys	For scholars, they felt highly engaged with, and a strong affinity to peers not the programme
Papalaskari et al. (65)	Adolescent magic “scholars” teaching magic to younger kids	Qualitative measures from focus groups and exit surveys	In addition to a strong affinity to peers, adolescents were aware of improved public speaking skills
NOTE: Where effect sizes were not reported, we have manually calculated effect size from given data, where possible. Non-significant at 95% confidence level is indicated by “n.s.”.			

adults who witness magic. Moreover, individual differences in curiosity (88) might predict who may actively try to discover the secrets and who might be more of a passive observer.

In summary, one overarching feature from empirical studies is the ability of magic to provoke curiosity and capture people’s interest. This interest has been used in a range of domains, such as distraction therapies (47, 50, 67), teaching in schools (41, 83), and physical therapies (40) as an engaging and motivating tool. Magic also appears to create an intrinsic motivation, due to the presence of strong elements of fun and positive emotions, which are motivating in their own right (89). This is indicative of joyous exploration curiosity from Kashdan et al.’s (88) curiosity framework, which relates to the joy of learning new knowledge. Other dimensions of curiosity may also be relevant, as discussed in the following sections, where different

elements of well-being are considered and possible theoretical mechanisms are suggested for each stage in the hierarchy.

WITNESSING MAGIC

Aside from joyous exploration, Kashdan et al.’s (88) curiosity dimension of stress tolerance is relevant, and entails a willingness to embrace doubt or confusion that arises from unexpected or mysterious events. Witnessing magic is an unexpected (12) and mysterious event, yet these intense emotions are experienced in safe, entertaining environments (9). Thus, watching magic may prove useful in arts-based interventions for increasing stress tolerance, which may have been the case in Lustig’s (49) AIDS magic show, where students learned about a potentially awkward and uncomfortable topic in the upbeat atmosphere of a magic show. Such interventions are also particularly useful since stress tolerance and joyous

TABLE 3. SUMMARY OF STUDIES WITH IMPLICATIONS FOR IMPROVED EMOTIONAL WELL-BEING FROM MAGIC, ACROSS LEVELS OF THE MAGIC AND WELL-BEING HIERARCHY

Reference	Sample size and type	Measures	Results with effect sizes (if applicable)
Witnessing Magic			
Subbotsky (66)	Experiment 1: Children N ₁ = 28 4-year-olds N ₂ = 28 6-year-olds (<i>P</i> = 0.009) N ₃ = 28 9-year-olds (<i>P</i> = 0.0002) Experiment 2: Adults <i>n</i> = 32 college students Experiment 3: Adults <i>n</i> = 34 college students Experiment 4: Adults <i>n</i> = 33 college students	Curiosity measured as proportion of participants who wanted to explore a magical versus counterintuitive non-magical effect, with varying levels of risk. Response frequencies of whether or not participant acknowledged the possibility of true magic in what they saw.	Magic tricks presented as magical elicited more curiosity to figure out the secret in children and adults, up until a certain risk threshold Experiment 1: Children 4-year-olds (<i>P</i> = 0.0007, * ϕ = 0.658) 6-year-olds (<i>P</i> = 0.009, * ϕ = 0.512) 9-year-olds (<i>P</i> = 0.0002, * ϕ = 0.722) Experiment 2: Adults College students (<i>P</i> = 0.003, * ϕ = 0.529) Experiment 3: Adults Higher risk (<i>P</i> = 0.017, * ϕ = 0.417) Highest risk (<i>P</i> = 0.08, n.s.) Experiment 4: Adults Zero risk (<i>P</i> = 0.48, n.s.) Possibility of magic (<i>P</i> < 0.001, * ϕ = 1.215)
Vagnoli, Caprilli, Robiglio, Messeri (67)	<i>n</i> = 40 Italian children	Modified Yale Preoperative Anxiety Scale (68) for child anxiety State-Trait Anxiety Inventory (69) for parent anxiety ratings Self-evaluation forms for clowns	Clowns doing magic reduced preoperative anxiety in children Child anxiety during anaesthesia induction (<i>P</i> = 0.001, * η^2 = .282) Control group anxiety increase (<i>P</i> = 0.001, * η^2 = 0.999) Clown group correlation for child anxiety between waiting and induction room (<i>r</i> = 0.93; <i>P</i> < 0.001) Correlation of self-evaluations with child anxiety Waiting room (<i>r</i> = 0.83; <i>P</i> < 0.001) Induction room (<i>r</i> = 0.77; <i>P</i> < 0.001) No other significant correlations or effects with parent anxiety
Discovering magic secrets			
Danek, Fraps, von Müller, Grothe, Öllinger (70)	<i>n</i> = 42 adults	Ratings on five dimensions of insight moments experienced	Of all the insight dimensions measured, happiness had the highest ratings Main effect of insight dimension (<i>P</i> < 0.01, η^2 = .268) Post hoc comparisons: Happiness higher than all other dimensions (<i>P</i> < 0.05) Impasse lower than all other dimensions (<i>P</i> < 0.05)
Performing magic			
Ezell and Klein-Ezell (71)	<i>n</i> = 26 children with disabilities	Self-image domain of Student Self-Concept Scale (72)	Self-esteem increased after magic intervention, compared to baseline (<i>P</i> < 0.001, <i>d</i> = 0.875)
Levin (73)	<i>n</i> = 6 resident adolescents in psychiatric hospital	Rosenberg Self-Esteem Scale (55)	After doing the magic programme, there was a numerical increase on 8 of the 10 items in the scale

TABLE 3. SUMMARY OF STUDIES WITH IMPLICATIONS FOR IMPROVED EMOTIONAL WELL-BEING FROM MAGIC, ACROSS LEVELS OF THE MAGIC AND WELL-BEING HIERARCHY

Reference	Sample size and type	Measures	Results with effect sizes (if applicable)
Lyons and Menolotto (61)	<i>n</i> = 6	Response frequencies on 7-point scale of affect and meaning of the magic (after intervention only)	Five of six participants rated the magic as both "exciting" and "pleasant" Six of six participants rated the magic as "refreshing"
Pravder et al. (16)	<i>n</i> = 100 5-to-16-year-old patients in paediatric hospital unit <i>n</i> = 95 caregivers <i>n</i> = 37 health professionals	Anxiety measures for 5-to-10-year old patients: Venham Picture Test (74) Facial Image Scale (75) Anxiety measures for 11-to-16-year-old patients: Facial Image Scale (75) State-Trait Anxiety Inventory (69) Anxiety measures for caregivers: State-Trait Anxiety Inventory (69) Health professionals Questionnaire on the effectiveness and practicality of the programme (67) Student magicians' ratings of patient reception 5-point ratings of the patient's interest, participation, reaction, and smiling	Magic therapy decreased patient anxiety with no interference to staff procedures Patient anxiety β coefficients for regression: Between groups ($P < 0.001$, $*d = 0.89$) n.s. for all covariates Caregiver anxiety β coefficients for regression: Between groups ($P < 0.001$, $*d = 0.05$) n.s. for all covariates Health professional questionnaire: 81% reported as helpful for child 57% reported as helpful for parents 47% reported as helpful for staff 97% reported as not a disturbance 95% recommended continuing programme Patient reception: Mean interaction score of 18.3/20
Spencer (41)*	<i>n</i> = 32 to 44 students	Hocus Focus Self-Efficacy Scale (41) Rosenberg Self-Esteem Scale (55) Qualitative data from teacher observations and student journals	Numerical increases on self-esteem scales (not possible to calculate effect sizes) Qualitative data revealed themes of improved self-esteem and improved motivation
Spencer and Balmer (63)	<i>n</i> = 21	Hocus Focus Self-Efficacy Scale Condensed Version (63) Rosenberg Self-Esteem Scale (55) 8-item Grit Scale (76)	Magic programme showed large numerical increases on self-efficacy, self-esteem, and grit (Not possible to calculate effect sizes based on manuscript)
Teaching with magic			
Papalaskari et al. (64)	Adolescent magic "scholars" teaching magic to younger kids	Qualitative measures from focus groups and exit surveys	Qualitative theme that students found the magic programme to be an intense, stimulating, and enjoyable environment for science learning
Papalaskari et al. (65)	Adolescent magic "scholars" teaching magic to younger kids	Qualitative measures from focus groups and exit surveys	Same as prior year, but with a deeper appreciation for science, theatre and teaching careers
Spencer (41)*		Qualitative measures from teacher notes and surveys	Teachers reported greater teaching efficacy, proficiency and satisfaction from using the Hocus Focus curriculum
NOTE: Where effect sizes were not reported, we have manually calculated effect size from given data, where possible. Non-significant at 95% confidence level is indicated by "n.s."			

exploration have the strongest correlations with high well-being (88).

Another positive emotion that may be elicited by witnessing magic is awe. Keltner and Haidt's (90) framework of awe has two main components relevant to magic: a need to assimilate

the experience into one's current mental structures, and a perceived sense of vastness. The need for assimilation in magic results from cognitive conflicts that are at the core of the magical experience (2, 9, 10). The second condition of perceived vastness is also satisfied because when a spectator watches effective magic, every possible explanation imagined

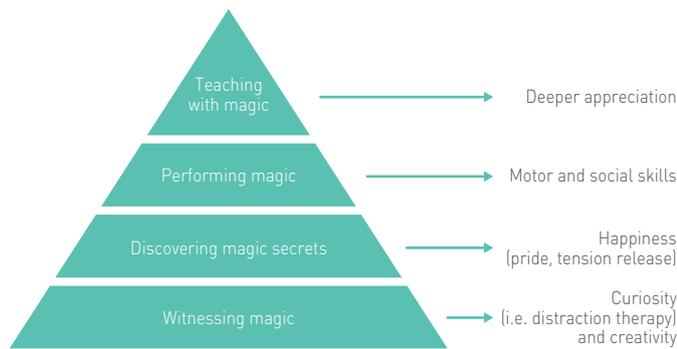
TABLE 4. SUMMARY OF STUDIES WITH IMPLICATIONS FOR IMPROVED COGNITIVE WELL-BEING FROM MAGIC, ACROSS LEVELS OF THE MAGIC AND WELL-BEING HIERARCHY

Reference	Sample size and type	Measures	Results with effect sizes (if applicable)
Witnessing magic			
Lustig (49)	$n = 266$ self-selected students	5-point Likert scale assessing AIDS knowledge	AIDS knowledge increased on questions about: Mosquitoes ($P < 0.001$, $*d = 0.383$) Donating blood ($P = 0.005$, $*d = 0.319$) Looking sick ($P = 0.007$, $*d = 0.304$) Latex condoms ($P < 0.001$, $*d = 0.319$)
Moss, Irons, Boland (77)	$n = 224$ participants crowdsourced online	Need for cognition scale (78) Engagement via absorption subscale of Schoolwork Engagement Inventory (79) Comprehension test of tutorial material (6-item true/false)	If secret was not revealed, need for cognition on subsequent, unrelated lecture material decreased ($P = 0.044$, $\eta^2 = 0.0014$) but did not affect comprehension ($P = 0.441$, $\eta^2 = 0.0011$). Magic also reduced engagement with lecture material ($P = 0.038$, $\eta^2 = 0.0041$)
Subbotsky (66)	Experiment 1: Children $N_1 = 28$ 4-year-olds $N_2 = 28$ 6-year-olds ($P = 0.009$) $N_3 = 28$ 9-year-olds ($P = 0.0002$) Experiment 2: Adults $n = 32$ college students Experiment 3: Adults $n = 34$ college students Experiment 4: Adults $n = 33$ college students	Curiosity measured as proportion of participants who wanted to explore a magical versus counterintuitive non-magical effect, with varying levels of risk Response frequencies of whether or not participant acknowledged the possibility of true magic in what they saw	Magic tricks presented as magical elicited more curiosity to figure out the secret in children and adults, up until a certain risk threshold: Experiment 1: Children 4-year-olds ($P = 0.0007$, $*\phi = 0.658$) 6-year-olds ($P = 0.009$, $*\phi = 0.512$) 9-year-olds ($P = 0.0002$, $*\phi = 0.722$) Experiment 2: Adults College students ($P = 0.003$, $*\phi = 0.529$) Experiment 3: Adults Higher risk ($P = 0.017$, $*\phi = 0.417$) Highest risk ($P = 0.08$, n.s.) Experiment 4: Adults Zero risk ($P = 0.48$, n.s.) Possibility of magic ($P < 0.001$, $*\phi = 1.215$)
Subbotsky, Hysted, Jones (80)	Experiment 1 $N_1 = 25$ 4-year-olds $N_2 = 27$ 6-year-olds Experiment 2 $N_1 = 32$ 6-year-olds $N_2 = 32$ 8-year-olds	Thinking Creatively in Action and Movement test (81) Blinded ratings of originality and non-reality for drawings of non-existent objects Magical Thinking Questionnaire (82)	Children scored higher on divergent creativity tests after watching magical films: Experiment 1: main effects of film Fluency ($P < .001$; $\eta^2 = 0.2$) Originality ($P < .001$; $\eta^2 = 0.3$) Imagination ($P < .001$; $\eta^2 = 0.6$) Experiment 1: drawings by 6-year-olds Originality score ($P < .001$; $d = 2.2$) Non-reality score ($P < .001$; $d = 2.8$) Experiment 2: main effects of film Fluency ($P < .001$; $\eta^2 = 0.21$) Originality ($P < .001$; $\eta^2 = 0.27$) Imagination ($P < .001$; $\eta^2 = 0.27$) Experiment 2: drawings by 6-year-olds Originality score ($P < 0.01$, $d = 1.5$) Non-reality score ($P < 0.05$, $d = 0.7$) Experiment 2: drawings by 8-year-olds No significant effects In all experiments, no significant effects for: Interaction effects Magical thinking scores

TABLE 4. SUMMARY OF STUDIES WITH IMPLICATIONS FOR IMPROVED COGNITIVE WELL-BEING FROM MAGIC, ACROSS LEVELS OF THE MAGIC AND WELL-BEING HIERARCHY

Reference	Sample size and type	Measures	Results with effect sizes (if applicable)
Discovering magic secrets			
Hilas and Politis (83)	<i>n</i> = 77 students (34 students in control semester, 33 in semester with new teaching approach)	5-point Likert scale in course evaluation surveys	Between semesters ($P = 1.43E-05$, $*d = 0.456$) Between courses ($P = 7.25E-08$, $*d = 0.586$)
Performing magic			
Schertz et al. (57)	<i>n</i> = 20 children with unilateral cerebral palsy with measures before, after, and at 8–10-week follow-up	Radiological scores Functional Magnetic Resonance Imaging (fMRI) Diffusion tensor imaging (DTI)	Radiological correlations: Positive correlation between radiological scores and both AHA ($r = 0.48, P < 0.05$) and CHEQ ($r = 0.63, P < 0.05$) Negative correlation between radiological scores and JTTHF ($r = -0.51, P < 0.02$) fMRI correlations: Negative correlation between ipsilesional hemisphere activation and AHA progress ($r = -0.61, P < 0.01$) at post-measure only Negative correlation between contralesional hemisphere and AHA at post-measure ($r = -0.56, P < 0.05$) and follow-up ($r = -0.48, P = 0.052$) DTI correlations: Negative correlations between AHA and fractional anisotropy in both affected ($r = -0.6, P < 0.05$) and less affected ($r = -0.50, P < 0.05$) corticospinal tracts at follow-up Negative correlation between CHEQ and fractional anisotropy in posterior limb of internal capsule at post-measure ($r = -0.55, P < 0.01$) and follow-up ($r = -0.66, P < 0.01$)
Spencer (41)*	<i>n</i> = 32 to 44 students	Qualitative data from teacher observations and student journals	Qualitative data revealed theme of improved concentration, memory, and ability to follow multi-step instructions
Sui and Sui (42)	<i>n</i> = 40 schizophrenia and depression patients	Chinese General Self-Efficacy scale (84)	Indication of potential divergent creativity from magic programme within self-efficacy scale (n.s. for overall score): Question on identifying multiple solutions ($P < 0.05$, $*d = 0.698$)
Weinstein et al. (60)	<i>n</i> = 12 children with hemiparesis with measure taken before, after, and at six-week follow-up	Magnetic Resonance (MR) Imaging Functional Magnetic Resonance Imaging (fMRI)	Improved neurological changes for hemiplegic children after magic camp: 26% increase in β values of affected hemisphere ($n = 7$), 35% at follow-up ($n = 4$) 4 of 12 showed improvements in lateralization index, and maintained at follow-up 7 children showed increased diffusivity values after intervention; 3 had increased diffusivity in affected hemisphere
Teaching with magic			
None.			
NOTE: Where effect sizes were not reported, we have manually calculated effect size from given data, where possible. Non-significant at 95% confidence level is indicated by "n.s.."			

FIG. 3. MAGIC AND WELL-BEING HIERARCHY, HIGHLIGHTING THE UNIQUE BENEFITS THAT EMERGE AT EACH STAGE, IN ADDITION TO THOSE FROM LOWER STAGES



would be disproven (2, 8-10). Therefore, spectators become aware of a vast number of possible explanations that must exist, including an unknown correct one that exceeds their understanding. Thus, spectators experience awe and become cognizant of knowledge gaps, even for the fundamental, physical laws of the universe learned through perception. Furthermore, if vastness arises from a great number of ideas and explanations, this would help explain the increases in

divergent creativity from watching magical content (42, 80), as indicated in Table 4. However, it is still unclear how awe interacts with curiosity. One possibility is that magic elicits an emotion that lies at the intersection of awe and curiosity, namely, that of wonder. This positive emotion of wonder would align with both 1) observations of emotional gradients between awe and curiosity in psychology research (91), and 2) a theoretical framework by Pritchard (92) suggesting that the distinction between awe and wonder is that wonder has a participatory element.

DISCOVERING THE SECRET OF MAGIC

Insight moments from discovering the secret to a trick were also associated with happiness ratings, with qualitative reports clarifying that these positive feelings came from tension release and pride (70). Therefore, pride and a sense of accomplishment seem to emerge at this stage. This pride, along with the initial curiosity, may then reinforce the desire to replicate the trick, thus motivating individuals to learn and perform magic.

PERFORMING MAGIC

The most apparent use of learning and performing magic is for improved physical well-being by developing motor

TABLE 5. SUMMARY OF STUDIES WITH IMPLICATIONS FOR IMPROVED BEHAVIOURAL WELL-BEING FROM MAGIC, ACROSS LEVELS OF THE MAGIC AND WELL-BEING HIERARCHY

Reference	Sample size and type	Measures	Results with effect sizes (if applicable)
Witnessing magic			
Peretz and Gluck (50)	n = 70 three-to-six-year-olds with strong-willed behaviour	Time to dental chair Ability to take dental radiographs	Improved cooperation from strong-willed children: Time to dental chair (P = 0.001, *d = 0.864) Radiographs (P = 0.0013, *φ = 0.261)
Discovering magic secrets			
None			
Performing magic			
Levin (73)	n = 6 resident adolescents in psychiatric hospital	Behaviour progress measures from hospital	Decreased interpersonal boundary violations from 120 to 42 Decreased number of time-outs from 82 to 31
Spencer (41)*	n = 32 to 44 students	Qualitative data from teacher observations and student journals	Qualitative data revealed theme of "positive impact on behaviour"
Spencer and Balmer (63)		Frequency of conversations initiated (number of tallies per time of observation period)	Students initiated more conversations in English after the magic programme (88.7% data points were above the highest baseline data point)
Teaching with magic			
None			
NOTE: Where effect sizes were not reported, we have manually calculated effect size from given data, where possible. Non-significant at 95% confidence level is indicated by "n.s.."			

skills in physical therapy. To achieve the deception for the magical effect, magicians use sleight of hand and carefully controlled body language. Sleights involve ultra-fine dexterous movements, whereas the magician's misdirection via his gaze, gestures, or body angle involves larger bodily movements. This wide range of both fine and gross physical movements allows the magic tricks to integrate effectively with many physical therapy exercises, which would explain the strong evidence of the effectiveness of Breathe Magic's summer camp for hemiplegic children (40, 57, 60).

Additionally, performing magic up close could enhance social relationships (41, 42) by improving the social skills required for positive relationships. Two prominent features of positive relationships are 1) sharing good news and 2) responding to it actively and constructively (93, 94). These active constructive responses are characterized by enthusiasm and encouraging the bearer of good news to relive that moment, thus capitalizing on associated positive emotions. These responses seem to be present in magic performances. As noted earlier, magic tricks elicit curiosity (9, 66), which reflects the constructive part of an active constructive response, where the recipient genuinely wants to learn more about the good news. In the case of magic, the good news is the new magic skill, which is shared through the performance. Moreover, surprise is a strong candidate for the experience of watching magic tricks (11-13). When combined with positive affect, surprise resembles enthusiasm, which is the second aspect of an active constructive response. Therefore, the nature of performing magic tricks is hypothesized to enhance social well-being by encouraging the active constructive responses present in positive relationships (95), which may partially explain the unique manner in which magical expertise develops in informal social settings (6).

TEACHING WITH MAGIC

Lastly, teaching with magic performances may yield unique benefits beyond those of performing magic. When children used magic to teach younger children, it resulted in deeper appreciation for the professions involved (64, 65). Similarly, qualitative data from Spencer's (41) study indicated a deeper appreciation of teaching from schoolteachers. In both cases, participants contributed an enjoyable learning experience to students, which resembles the meaning element of PERMA (85) that is defined by serving something greater than the self (for example the students). Therefore, this meaningful appreciation of teaching might come from a noble sense of contribution rather than positive affect. While not unique to magic, this added aspect of contribution via magic performances is a worthwhile pursuit of future research.

CONCLUSIONS AND IMPLICATIONS

As seen in this review, magic has been used to enhance well-being in physical, affective, cognitive, and social domains throughout both active programmes and emerging empirical studies. We have observed the use of magic as a motivating tool in both. A common application for programmes is physical therapy but other settings include schools, hospitals, psychological therapy, and lifestyle interventions. Empirical studies show positive effects, but many have weak methodologies, warranting further research.

Despite the shortcomings, our review has found that witnessing magic enhances affective and cognitive well-being by inspiring intense curiosity, which has been used as a distraction therapy. We believe that this ability to capture interest, along with feelings of awe, may be fundamental to the emotional experience of well performed magic. This combination of curiosity and awe can be thought of as wonder. Thus, magic would be ideal for beginning a scientific study of wonder. Timing for such research is also opportune, given recent strides in measuring both curiosity (88) and awe (96). Implications of such research are highly promising, as the first step in any intervention is to engage people's interest so that they focus fully on the intervention content that matters most. Additionally, it is possible that well-being benefits of curiosity and awe transfer to experiences of wonder. For curiosity, the relevant dimensions that are most useful would be joyous exploration and stress tolerance, due to their strong associations with well-being (88). For awe, well-being benefits include increased prosocial behaviour (97), enhanced attention (98), decreased aggressive behaviour (99), and creative benefits (100). Other fruitful avenues of witnessing magic may include the manner in which individual differences in curiosity relate to enjoyment of magic and determining key factors of a performance that affect different types of curiosity.

Similarly, discovering the secrets of magic was linked to pleasant emotions from insight experiences. Performing magic builds upon this by showcasing improved social and motor skills, while retaining at least some aspects from prior stages. Thus, magic is worth exploring as an interesting and enjoyable type of social skills training. Finally, using magic to teach may cultivate a deep sense of meaning and appreciation for one's teaching contributions. During each of these stages, there appears to be a sense of well-being, motivating progress towards the next. In this review, we offered a framework that

helps structure these different approaches and suggested theoretical models that may account for positive effects.

Many avenues of magic and well-being remain largely unexplored. Well designed experiments will be very helpful in clarifying the mechanisms at play and this has already begun with the advent of studies like Pravder et al. (43). Moreover, we hope that new theoretical insights in our understanding of magic will help further this process. Characterizing emotional and social experiences would provide an excellent foundation, since magic is both entertainment and it is often performed in social settings. This solid foundation could then be used to investigate interactions with physical or cognitive well-being, and further clarify whether well-being emerges through processes such as positive emotions and active constructive responding, or perhaps guide us to more unexpected mechanisms. In doing so, the magic programmes focused on well-being can better capitalize on the most fruitful aspects of magic. Professional entertainers can gain better professional opportunities, and more effective, more inclusive approaches can be created together with health-care practitioners to help both the disadvantaged and the general public to lead more meaningful, flourishing lives.

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