PEC Innovation 3 (2023) 100194

Contents lists available at ScienceDirect

PEC Innovation

journal homepage: www.elsevier.com/locate/pecinn

Using nominal group technique to determine skills that applied improvisation can teach health profession education learners

Carolyn A. Chan [a,*], Erica Chou [b], Anne Graff LaDisa [c], Ankit Mehta [d], Amy Zelenski [e], Krista Longtin [f,g]

[a] Section of General Internal Medicine, Department of Internal Medicine, Yale School of Medicine, New Haven, USA
[b] Section of Pediatric Hospital Medicine, Department of Pediatrics, Medical College of Wisconsin, Milwaukee, USA
[c] Department of Pharmacy Practice, Concordia University Wisconsin School of Pharmacy, Mequon, USA
[d] Department of Internal Medicine, University of Minnesota, Minneapolis, USA
[e] Division of General Internal Medicine, Department of Medicine, University of Wisconsin School of Medicine and Public Health, Madison, USA
[f] Department of Communication Studies, IUPUI, USA
[g] Indiana University School of Medicine, Indianapolis, USA

ARTICLE INFO

Keywords:
Improvisation
Theater
Communication
Health professions education
Curriculum design

ABSTRACT

Objective: Applied improvisation (AI) is an approach used in health professions (HP) education to teach skills essential for clinical practice such as communication, teamwork, and empathy. Little is known about which skills can be developed using AI, or those which an AI should prioritize. Our research aims to identify skills essential to include in an AI curriculum for HP learners.

Methods: A modified nominal group technique (NGT) was conducted to identify and prioritize specific skills which can be taught using AI. This involved silent generation of ideas, round robin, discussions, 2-rounds of preliminary voting, and a final ranking survey to determine a prioritized list of skills to include in an AI curriculum for HP learners.

Results: Six content experts participated in the NGT meeting. Initially, 83 skills were identified, and through NGT, a final list of 11 skills essential to an AI curriculum were determined including: adaptability, affirmation of others, acceptance, active listening, being present, cooperation, collaboration with other, advancement, compassionate communication, sharpened non-verbal communication, resilience.

Conclusion: Essential skills for an AI curriculum relate to adaptability, attunement, collaboration, affirmation, and advancement.

Innovation: This study is a novel application of NGT as a strategy to organize an approach to curriculum innovations.

1. Introduction

Health professions (HP) educators have long used arts and humanities to teach essential skills that may not be easily taught during clinical practice such as reflection, empathy, and interpersonal communication [1]. This has led HP educational organizations to officially recognize the benefits of including arts and humanities throughout the training continuum [2]. Arts and humanities techniques are effective, in part, because they can illuminate certain understandings which are not readily available to our conscious minds by tapping into the embodied mind. Though we see and feel the benefits of these techniques, we have a responsibility to adequately measure their effectiveness for the broader medical education community [3]. Moniz et al. found that "While the uses of the arts and humanities in this published literature are rich and diverse, the knowledge arising from these activities is relatively impoverished due to compartmentalization, a lack of theory, and missing perspectives." (p.1220) [1].

Improvisational theater is a style of performance that is made up spontaneously and in the moment. Although performances are unscripted, actors still abide by agreed-upon principles and techniques to create successful performances. Applied improvisation (AI) leverages the principles and activities used in improvisational theater to teach skills essential to clinical healthcare practice such as teamwork, communication, and empathy [4-7]. AI has been used effectively to

* Corresponding author at: 367 Cedar Street, Harkness Hall A Suite – Suite 417A, New Haven, CT 06510, USA.
E-mail address: carolyn.chan@yale.edu (C.A. Chan).

https://doi.org/10.1016/j.pecinn.2023.100194
Received 23 December 2022; Received in revised form 20 July 2023; Accepted 24 July 2023
Available online 25 July 2023

teach students to communicate with patients and team members with more clarity and empathy. [8] Hoffmann-Longtin et al. crystallized their experiences using AI into tips for medical educators wanting to use these methods. They encourage teachers and curriculum designers to intentionally choose activities to address the skills they would like to teach and to harness the power of the improvisation mindset at the same time [9]. Fu wrote about three curricular components of improv: skills, principles, and exercises. Similar to Hoffmann-Longtin et al., these components leverage not only the skills practice that improv provides but also the mindset. Fu explores the skills further to delineate three "master skills" of improv: attunement, affirmation, and advancement (p. 6) [10]. Each of these master skills contains component skills that Fu maps to the milestones and entrustable professional activities used in medical education to evaluate learners in a competency-based framework.

Language and principles from improv techniques are commonly used in AI curricula. Here we will provide exemplary common concepts derived from improv theater frequently utilized in AI: "Yes-ing", "And-ing", "Attunement", "Adaptability", and "Collaboration" [10]. The concept of "Yes-ing" represents the affirmation or validation of self and others [10]. It involves the acceptance of ideas, others, or circumstances presented in a particular situation or context. The concept of "And-ing" refers to advancing the agenda with clear verbal and nonverbal communication [10]. These two concepts complete a well-known improv concept of "Yes, And" which is essential in contributing, responding, and participating in narrative development. "Attunement" involves attention, awareness, presence, active listening, perceiving, and recognizing cues [10]. Successful improvisation requires insight into our own behaviors – (self-awareness, self-management) along with engagement in others' perspectives. The concept of "adaptability" asks individuals to be flexible and adjust quickly to new conditions. Lastly, "collaboration" is crucial in improv, and is the act of working with other individuals to co-create something

Although AI interventions have been tested, an agreed upon understanding of the overall goals of this pedagogical technique is lacking [4,7,11-13]. Expert consensus will better equip HP educators to design educational experiences and conduct future interventions using a common language to assess the effectiveness of AI in HP education. AI can be utilized to teach many skills in HP education but not everything. We need to better understand the strengths and limitations of AI in HP education in order to leverage where it is most effective. In this study, we aim to distill a consensus of what skills should be included in an AI curriculum for HP learners.

2. Methods

We used a modified nominal group technique (NGT) to prioritize specific skills for AI curriculum for HP learners [14]. NGT is a widely-used method to generate ideas and reach consensus among experts; in particular, it is a common technique to prioritize curricular goals [15]. For our purpose (developing a list of prioritized skills suitable to teach using AI), the NGT allowed us to accomplish this task. With the NGT technique, two to fourteen participants have been utilized, and a maximum of seven has been recommended for a robust discussion of concepts [16]. We held one two-hour meeting with a total of six participants and three facilitators using standard NGT protocol.

2.1. Sampling

We worked with the Medical Improv Collaborative (MIC), a community of approximately 50 medical improv practitioners and educators, to recruit participants. The MIC is dedicated to enhancing the quality, integrity, and humanity of medical care by providing validated research and improv resources for medical education and therapeutic practices. We used purposive sampling to invite a subset of MIC members to the NGT meeting to ensure that there was representation across the diverse categories of members. In order to be a MIC member, individuals must have experience as an AI educator which we defined as individuals who have taught at least 1 or more medical improv workshops to health care professionals. Furthermore, many are clinicians, including trainees or practitioners in any healthcare field (e.g. medicine, dentistry, pharmacy, psychology, nursing, etc.), and improviser actors, who are individuals with training and experience in improv outside of an AI context. In our sample, we sought to ensure that these combinations of member categories were represented as follows: 1) clinician/improviser/AI educator; 2) clinician/AI educator; and 3) improviser/AI educator. Our sample included individuals within each of the 3 categories to help make the group representative of MIC. Furthermore, within the MIC, we sought members with the most years of experience teaching medical improv. We included a diverse range of health professionals in this process. Participants completed a demographic survey asking their years of experience, professional role, and types of learners for which they had taught AI (appendix).

2.2. Nominal group technique

We held one, two-hour NGT meeting via video conferencing with a total of six participants (Fig. 1). Following a modified NGT, we provided a 10-min PowerPoint to establish definitions for "applied improv", "skills", and "health professions learners" [14]. We defined "skills" as a specific ability an individual possesses, and "HP learners" to include students in any health or social care profession. Next, we asked participants to generate a list of skills independently and silently they thought AI could teach HP learners. We then used a round-robin strategy for individuals to share their ideas. Afterward, we facilitated a group discussion, encouraging individuals to consolidate similar ideas, ask clarifying questions, and categorize their ideas. As a result of this process, fewer skills moved forward based on condensing of similar skills into one, as well as changing a couple of skills to categories.

Once we identified the skills, a group discussion occurred where they categorized the skills. Sometimes the participants selected one skill to become the umbrella term to represent the broad category, followed by grouping skills underneath to represent the nuances of the skill within the specified category.

Next we asked individuals to complete the first round of preliminary

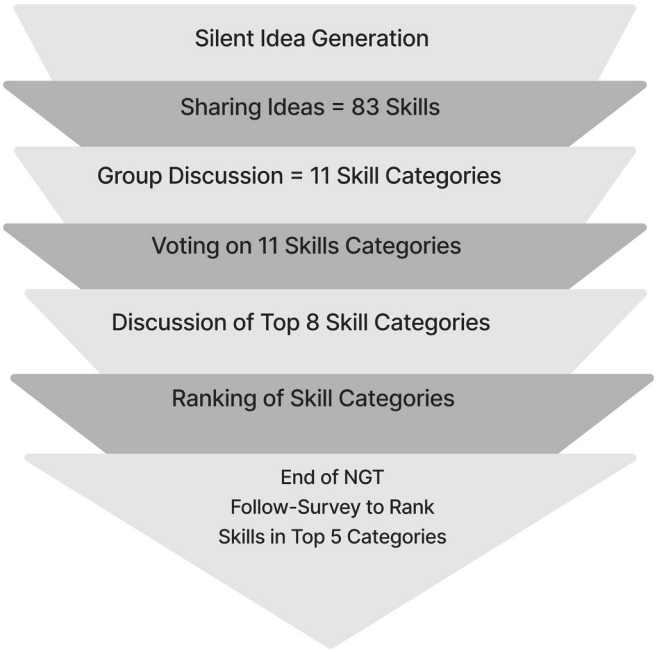

Fig. 1. The steps in our nominal group technique are listed below.

voting through an anonymous survey online Qualtrics survey (see Fig. 1 for the NGT methodology overview), where they could vote "yes", "no", or "maybe" to prioritize the category. Based on the results from round 1 of preliminary voting, only the categories that received 100% of agreement of "yes" votes, moved to round two of discussion. The top categories then moved to the second round of discussion, where we asked participants to clarify and discuss the individual items under each category. In round 2 of preliminary voting, participants ranked the overarching categories from high to low priority that they would prioritize in an AI curriculum for HP learners. The five highest ranked categories along with their associated skills moved forward to the round 3, the final round of voting. (Table 2a) After the NGT meeting was complete, we sent participants a Qualtrics survey asking them to rank specific skills under each of the five categories from most important to least important. This study was deemed exempt by the Yale IRB, University of Wisconsin-Madison IRB, and Concordia University of Wisconsin IRB.

2.3. Data analysis

Consensus can be determined in a multitude of ways, one common mechanism is by pre-defining consensus as a range of percent agreement among participants [15]. We defined consensus prior to reviewing the results and distinguished it as having 83.3% (5 of 6) of individuals in the group rank an individual skill within the top 50th percentile of skills within each specified category.

3. Results

3.1. Demographics of NGT group

Of the six participants in our NGT meeting, 50% were female and 50% were male. 83.3% had 7–8 years of experience teaching AI, while 16.7% reported more than eight years of experience. Within the group, individuals identified themselves as improviser-healthcare educator (33.3%), clinician-medical improv educator (50.0%), and clinician-improviser-medical improv educator (16.7%). The health professions of clinicians included two physicians of different specialties, and a psychologist. All participants had experience teaching medical students, residents and/or fellows, as well as attending physicians. Furthermore, individuals reported experiences teaching other HP learners such as nursing students (50%), physician assistant students (50%), dental students (16.7%), and other HPE learners (50%) (Table 1, Survey in Appendix).

3.2. First round of NGT

The first round-robin generated a list of 83 individual skills (Appendix List 1a). During the discussion individuals clarified and condensed terms as well as created 11 overarching categories for these skills (Table 2). In the round 1 of preliminary voting, individuals voted "yes", "no" or "maybe" to prioritize each of these 11 categories. Eight categories (comprised of 77 individual skills) had 100% of voter agreement of "yes" to include for the next round. These categories included: adaptability, and-ing, attunement, collaboration, emotions, risk, uncertainty, and yes-ing (Appendix Table 2a).

3.3. Second round of NGT voting

We then asked individuals to rank these eight categories from highest to lowest priority. Categories that had votes within the top three for all participants were moved to the final round of voting, which left a total of 5 overarching categories that included 59 individual skills. These categories were: adaptability, and-ing, attunement, collaboration, and yes-ing (Appendix Table 2a).

Table 1
Demographics and professional experiences of nominal group participants.

Characteristics of Respondents		No. (%)
Experience of Respondents	Improviser and Medical Improv Educator	2 (33.3%)
	Clinician and Medical Improv Educator	3 (50.0%)
	Clinician, Improviser, and Medical Improv Educator	1 (16.7%)
Years of Experience Teaching Medical Improv	7–8 years	5 (83.3%)
	More than 8 years	1 (16.7%)
*Years of Experience as a Practicing Clinician (if applicable)**	More than 8 years	4 (100%)
Type of learner you have taught medical improv	Medical Students	6 (100%)
	Medical Residents and/or fellows	6 (100%)
	Attending Physicians	6 (100%)
	Nursing Students	3 (50.0%)
	Practicing Nurses	3 (50.0%)
	Physician Assistant Students	3 (50.0%)
	Dental Students	1 (16.7%)
	Other:	3 (50.0%)

3.4. Final round of NGT voting

We then provided participants with the final list of the five categories (including a total 59 individual skills) and asked them to prioritize the skills within each category from highest to lowest. Consensus was defined as having 5 out of 6 individuals in the group rank an individual skill within the top 50th percentile (Appendix Table 2a).

3.5. Skills consensus

The experts participating in our NGT identified eleven skills across five categories that should be prioritized in an AI curriculum for HP learners (Table 3). Within the *adaptability* category, the skill that we reached consensus on was *adaptability/adaptation*, with all 6 of the participants in agreement (Table 4). Two of eight skills met consensus for the category of *attunement*: *active listening* (6 out of 6) and *being present* (5 out of 6) (Table 5). For the *collaboration* category, two of twelve skills met consensus criteria: *cooperation* (5 out of 6) and *collaboration with others* (5 out of 6) (Table 6). In the *Yes-ing* category, two of twelve skills met consensus criteria: *affirmation of others* (5 out of 6) and *acceptance* (5 out of 6) (Table 7). For the category of *And-ing* (with 21 skills), four met consensus criteria: *advancement* (6 out of 6), *compassionate communication* (6 out of 6), *sharpened non-verbal communication* (5 out of 6), and *resilience* (5 out of 6) (Table 8).

4. Discussion and conclusion

4.1. Discussion

The results of this study have implications for AI educators, as well as for the role of AI in HP education and HP educators, more broadly. First, participants identified 83 discrete skills that improvisation could be used to teach, supporting extant literature that AI has a broad educational scope. This long and varied list includes many skills also listed within competencies of HP accreditation (i.e. ACGME competencies) [17]. For example, our experts listed a variety of skills which would fall into the competency of "interpersonal and communication skills," including

Table 2
Results of categories with definitions and skills from the discussion prior to preliminary voting.

Category	Skill
Adaptability: The ability to be flexible and adjust quickly to new conditions	1. Adaptability 2. Agility 3. Flexibility 4. Willingness to be changed by new perspective 5. Adaptation 6. Adjustment to feedback 7. Adjustment of focus 8. Spontaneity 9. Tolerance of uncertainty
And-ing: Advancing an agenda with clear verbal and non-verbal communication.	10. Advancement 11. Compassionate communication 12. Resiliency 13. Status 14. Delivering information 15. Observation 16. Sharpened non-verbal communication 17. Confirmation 18. Cue delivery 19. Narrative 20. Reincorporation 21. Synthesis 22. Resource incorporation 23. Recall 24. Idea generation 25. Clarity 26. Justification 27. Silence 28. Cue modulation 29. Reflection 30. Summation
Attunement* To be aware and have knowledge of self and others.	31. Presence 32. Mindfulness 33. Focus 34. Active listening 35. Listening 36. Being present 37. Heightened awareness 38. Self-awareness 39. Perception 40. Perspective taking
Collaboration Act of working with other individuals to co-create something.	41. Cooperation 42. Collaboration with others 43. Connection 44. Generation 45. Agreement 46. Willingness to connect 47. Making connections 48. Contribution 49. Shared purpose 50. Support 51. Trust
Curiosity* Attitude marked by a desire to learn and investigate	52. Discovery 53. Playfulness 54. Creativity
Emotions Recognition of feeling and state of mind.	55. Emotional awareness of self and others 56. Empathy 57. Empathic awareness 58. Reading emotions 59. Cue recognition
Risk Ability to pursue an action that could result in something bad or unpleasant	60. Comfort with failure 61. Comfort with risk 62. Risk-taking 63. Courage 64. Vulnerability 65. Fallibility 66. Authenticity 67. Honesty 68. Confidence
Yes-ing The affirmation, or validation of self and others.	69. Affirmation - self, others, circumstances 70. Reflections 71. Validation 72. Acceptance 73. Acknowledgment 74. Appreciation 75. Encouragement 76. Generosity 77. Kindness 78. Morale
Wellness* State of healthy habits for physical and mental health	N/A
Communication* Exchanging information	N/A

* These were originally described as skills in round 1 of the nominal group technique, later the respondents determined they were categories, that were too broad to group and associate with the existing list of skills.

Table 3
Summary of final categories and skills that reached consensus.

Category	Skill
Adaptability	• Adaptability/adaptation
Attunement	• Active listening • Being present
Collaboration	• Cooperation • Collaboration with others
Yes-ing	• Affirmation of others • Acceptance
And-ing	• Advancement • Compassionate communication • Sharpened non-verbal communication • Resilience

Table 4
Number of votes at the rank priority listed with 1 = highest priority, along with the percent of individuals who ranked the item in the top 50th percentile of skills within the adaptability category. Bolded items are included in the 11 final skills that met consensus criteria through the NGT process.

	# Rank list of priorities and # of individuals who voted for it.				
Skills in **Adaptability** Category	**1**	**2**	**3**	**4**	# of individuals who ranked item in their top 4 prioritized items
Adaptability/Adaptation	4	1	0	1	**6**
Flexibility	1	1	1	1	4
Willingness to be changed by a new perspective	0	2	0	1	3
Spontaneity	0	1	2	0	3
Adjustment to feedback	0	0	3	0	3
Adjustment of focus	0	0	0	1	1

active listening and empathy. Prior studies have shown the impact of improv training on communication and empathy [4,7,11,18]. Often within these curricula communication skills are defined broadly and can make assessment of these curricula challenging [19]. The list generated here can be utilized to develop and improve curriculum for specific skills within communication skills training. For example, future curricula on communication could focus on active listening, showing compassion, and sharpening non-verbal skills, thus refining AI curricula design and assessment.

In addition, many challenges remain to interprofessional education in healthcare, and many seek to improve teamwork skills through a wide range of learning activities [20]. Collaboration was a key skill within our list, suggesting that AI may be a tool to assist teaching teamwork within

Table 5
Number of votes at the rank priority listed with 1 = highest priority, along with the percent of individuals who ranked the item in the top 50th percentile of skills within the attunement category. Bolded items are included in the 11 final skills that met consensus criteria through the NGT process.

	# Rank list of priorities and # of individuals who voted for it.				
Skills in **Attunement** Category	**1**	**2**	**3**	**4**	#of individuals who ranked item in their top 4 prioritized items
Active Listening	1	3	1	1	**6**
Being Present	3	0	2	0	**5**
Mindfulness	0	0	2	1	3
Heightened awareness	1	1	0	1	3
Self-Awareness	0	1	0	1	2
Perception	0	1	0	1	2
Perspective Taking	0	0	1	0	1
Focus	1	0	0	1	1

Table 6
Number of votes at the rank priority listed with 1 = highest priority, along with the percent of individuals who ranked the item in the top 50th percentile of skills within the collaboration category. Bolded items are included in the 11 final skills that met consensus criteria through the NGT process.

	# Rank list of priorities and # of individuals who voted for it.					
Skills in **Collaboration** Category	**1**	**2**	**3**	**4**	**5**	# of individuals who ranked item in their top 5 prioritized items
Cooperation	0	0	3	2	0	**5**
Collaboration with others	2	0	0	1	2	**5**
Making Connections	2	1	1	0	0	4
Willingness to connect	1	2	0	1	0	4
Trust	0	2	1	1	0	4
Support	0	1	1	0	1	3
Shared Purpose	0	0	0	1	2	3
Agreement	1	0	0	0	1	2
Contribution	0	0	0	0	0	0
Generation	0	0	0	0	0	0

Table 7
Number of votes at the rank priority listed with 1 = highest priority, along with the percent of individuals who ranked the item in the top 50th percentile of skills within the Yes'ing category. Bolded items are included in the 11 final skills that met consensus criteria through the NGT process.

	# Rank list of priorities and # of individuals who voted for it.						
Skills in **Yes'ing** Category	**1**	**2**	**3**	**4**	**5**	**6**	# of individuals who ranked item in top 6
Affirmation of others	2	2	1	0	0	0	**5**
Acceptance	1	0	0	2	0	2	**5**
Affirmation of Circumstances	0	1	2	1	0	0	4
Acknowledgement	1	0	1	0	2	0	4
Affirmation of Self	1	2	0	0	0	0	3
Generosity	0	0	0	1	0	2	3
Validation	0	0	1	1	1	0	3
Encouragement	0	0	0	0	1	1	2
Appreciation	0	0	0	0	1	0	1
Kindness	0	0	0	0	0	0	0
Morale	0	0	0	0	0	0	0
Reflection	0	0	0	0	0	0	0

interprofessional education. A foundational ethic in AI is a focus on the team, rather than on an individual [21]. Specific skills such as cooperation (the ability to assist others when needed) and collaboration (the ability to bring a shared agenda to fruition) may be prioritized through AI to build the groundwork for teamwork skills within HP education. These skills are essential in healthcare to form therapeutic relationships, operate in teams and develop cultural humility. AI can inculcate and foster the ability to participate effectively in groups.

Furthermore, the list generated in this study also aligned with a proposed framework by Fu to develop AI curricula [10]. The proposed framework is based on three core skill groups of attunement, affirmation, and advancement [10]. All three of these items were generated in the NGT, supporting existing evidence that this theoretical framework for AI can be utilized for curriculum development.

Recently, AI has been proposed as a mechanism to build resiliency, and a virtual AI curriculum has shown promise to improve wellbeing among medical students [22,23]. Key skills generated in our study included resilience and being present, which may be incorporated into wellness curricula. Furthermore, skills such as affirmation and acceptance teach the practice of acknowledgement of ideas, perspectives, or circumstances presented in a particular situation or context. These skills are essential in healthcare to form therapeutic relationships, operate in teams, and develop cultural humility.

A final key skill on our generated list is adaptability. Adaptability is a skill that all healthcare providers need to respond effectively to evolving clinical situations. Prior assessment of AI curricula has suggested that it improves participants ability to think on their feet [4,24]. This is a notably challenging skill to teach, as traditional HP education is often rigid and structured, which is unlike the ever-changing clinical practice. Future research should determine if AI can improve the adaptability of learners within high pressure clinical environments.

Overall, this expert-generated list of skills can assist individuals in developing AI curricula for HP learners. The overarching categories can be considered to inform the goals and purposes of AI curricula, while the list of specific skills could be utilized to inform curricula learning objectives. The list of categories and skills provides insight into skills that AI may be well suited to teach vs skills that are less suited to the use of AI as a teaching pedagogy. In addition, they could be utilized with the curricula content design by providing suggestions for skills to align with specific improv exercises. Future work should consider refining this list in different contexts for health professionals.

The above strengths notwithstanding, we acknowledge several limitations to this study. We lacked representation of all categories of interprofessional clinicians. Our group consisted of six experts in the field based on their clinical, interprofessional, and medical improvisation education experience. Yet, due to limitations within medical improvisation expertise, we could only recruit representatives within three HP disciplines. In addition, this group included a small ($n = 6$) number of expert perspectives. Future studies could build upon our findings using a survey or Delphi technique to capture the perspectives of a larger number of medical improv experts. The small sample and limitations of 3 HP disciplines could limit the generalizability of our findings to all HP learners.

In addition, participants' opinions were discussed openly in real time, which could have introduced a social desirability bias to vote in a certain way, though we tried to minimize this by ensuring each round's voting results were anonymous.

4.2. Innovation

This study is a first attempt to understand the scope of skills that AI curricula can teach. The eleven distinct, prioritized skills that reached consensus with our participants are adaptability, affirmation of others, acceptance, active listening, being present, cooperation, collaboration, advancement, compassionate communication, non-verbal communication, and resilience. AI is an adaptable pedagogical approach. Like simulation, role play, or case-based learning, it could be easy to enlist AI to teach skills in HP education for which traditional didactics are not well-suited.

Table 8
Number of votes at the rank priority listed with 1 = highest priority, along with the percent of individuals who ranked the item in the top 50th percentile of skills within the And'ing category. Bolded items are included in the 11 final skills that met consensus criteria through the NGT process.

	# Rank list of priorities and # of individuals who voted for it.										
Skills in **And'ing** Category	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	# of individuals who ranked item in top 10
Advancement	5	1	0	0	0	0	0	0	0	0	**6**
Compassionate Communication	0	3	1	1	0	1	0	0	0	0	**6**
Sharpened non-verbal communication	0	0	1	1	0	2	1	0	0	0	**5**
Resiliency	0	0	0	2	0	1	0	1	0	1	**5**
Delivering information	0	0	1	0	0	0	1	1	0	1	4
Observation	0	0	0	0	2	0	0	0	1	1	4
Cue Delivery	0	1	1	0	0	1	0	0	0	0	3
Confirmation	0	1	0	0	0	0	0	1	1	0	3
Synthesis	0	0	0	0	0	1	1	1	0	0	3
Status	0	0	0	0	0	0	1	0	2	0	3
Idea Generation	1	0	0	1	0	0	0	0	0	0	2
Cue Modulation	0	0	1	1	0	0	0	0	0	0	2
Reflection	0	0	1	0	1	0	0	0	0	0	2
Resource Incorporation	0	0	0	1	0	0	0	0	1	0	2
Recall	0	0	0	0	1	0	0	0	0	1	2
Summation	0	0	0	0	0	0	1	1	0	0	2
Narrative	0	0	0	0	0	0	0	1	1	0	2
Reincorporation	0	0	0	0	0	0	0	0	0	2	2
Clarity	0	0	0	0	1	0	0	0	0	0	1
Silence	0	0	0	0	0	0	1	0	0	0	1
Justification	0	0	0	0	0	0	0	0	0	0	0

This work has implications for HP curriculum design and assessment as described in the discussion. First, these results can be used to inform future AI curricula within HPs to a targeted list of skills optimized for learners. This study lays the groundwork for a future conceptual framework for interprofessional AI curricula for HP learners. The original list of 83 skills developed during the idea generation stage of the NGT could serve as a springboard for tailored AI curricula (Appendix List 1a). Secondly, this study prioritizes skills in an AI curriculum, thus encouraging experts to focus efforts on assessing curricula in these areas. If AI is to become a more widely-used pedagogical approach, it is important for HP educators to know which skills it is suited to teach and to what extent it is effective.

Finally, this study is a novel application of NGT as a strategy to organize an approach to a curriculum innovation. As team-based learning was adapted for HP education in the early 1990s, practitioners gathered to identify promising approaches and find funding to study it as an educational strategy [25]. Early definitional work was critical to its success and proliferation. The same is true for AI. As a relatively new teaching strategy in HP education, foundational work like this is needed to ensure its effectiveness [10].

4.3. Conclusion

AI is a novel pedagogy and can be utilized to teach a variety of skills critical to HP. Prioritized skills that med improv curricula can be used to teach HP learners include the following: adaptability, active listening, being present, cooperation, collaboration with others, affirmation of others, acceptance, advancement, compassionate communication, sharpened non-verbal communication, and resilience. Future research should include curriculum development and assessment of these AI curricula.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CRediT authorship contribution statement

Carolyn A. Chan: Conceptualization, Highlightsmethodology, Formal analysis, Investigation, Writing – original draft. **Erica Chou:** Conceptualization, Writing – review & editing. **Anne Graff LaDisa:** Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft. **Ankit Mehta:** Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft. **Amy Zelenski:** Conceptualization, Methodology, Investigation, Writing – original draft. **Krista Longtin:** Conceptualization, Methodology, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to acknowledge Belinda Fu MD, Dan Sipp, Elizabeth Weinstein MD, John-Michael Maury, and Shannon Hanson PhD for contributing their knowledge and expertise to the NGT. We would like to acknowledge Donna Windish, MD, MPH, and Janet Hafler, EdD for their feedback on the methodology of the study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pecinn.2023.100194.

References

[1] Moniz T, Golafshani M, Gaspar CM, Adams NE, Haidet P, Sukhera J, et al. How are the arts and humanities used in medical education? Results of a scoping review. Acad Med 2021;96(8):1213–22.
[2] Howley L, Gaufberg E, King BE. The fundamental role of the arts and humanities in medical education. Association of American Medical Colleges; 2020.
[3] Peterkin AD, Skorzewska A. Health humanities in postgraduate medical education. Oxford University Press; 2018.
[4] Zelenski AB, Saldivar N, Park LS, Schoenleber V, Osman F, Kraemer S. Interprofessional Improv: using theater techniques to teach health professions students empathy in teams. Acad Med 2020;95(8):1210–4.
[5] Kukora SK, Batell B, Umoren R, Gray MM, Ravi N, Thompson C, et al. Hilariously bad news: medical Improv as a novel approach to teach communication skills for bad news disclosure. Acad Pediatr 2020;20(6):879–81.
[6] Donovan EE, Brown LE, Rush SK, Greenwell MR, Table B, Zhu YG, et al. An applied improvisational pharmacy communication workshop implemented during orientation for first-year pharmacy students. Am J Pharm Educ 2020;84(1):15–21.

[7] Cai F, Ruhotina M, Bowler M, Howard E, Has P, Frishman GN, et al. Can I get a suggestion? Medical improv as a tool for empathy training in obstetrics and gynecology residents. Journal of Graduate Medical Education 2019;11(5):597–600.
[8] Kaplan-Liss E, Lantz-Gefroh V, Bass E, Killebrew D, Ponzio NM, Savi C, et al. Teaching medical students to communicate with empathy and clarity using improvisation. Acad Med 2018;93(3):440–3.
[9] Hoffmann-Longtin K, Rossing JP, Weinstein E. Twelve tips for using applied improvisation in medical education. Med Teach 2018;40(4):351–6.
[10] Fu B. Common ground: frameworks for teaching improvisational ability in medical education. Teach Learn Med 2019;31(3):342–55.
[11] Fessell D, McKean E, Wagenschutz H, Cole M, Santen SA, Cermak R, et al. Medical improvisation training for all medical students: 3-year experience. Medical Science Educator 2020;30(1):87–90.
[12] Hammer RR, Rian JD, Gregory JK, Bostwick JM, Birk CB, Chalfant L, et al. Telling the patient's story: using theatre training to improve case presentation skills. Med Humanit 2011;37(1):18–22.
[13] Hoffmann-Longtin K, Organ JM, Helphinstine JV, Reinoso DR, Morgan ZS, Weinstein E. Teaching advocacy communication to pediatric residents: the efficacy of applied improvisational theater (AIT) as an instructional tool. Communication Education 2018;67(4):438–59.
[14] Humphrey-Murto S, Varpio L, Wood TJ, Gonsalves C, Ufholz L-A, Mascioli K, et al. The use of the Delphi and other consensus group methods in medical education research: a review. Acad Med 2017;92(10):1491–8.
[15] Foth T, Efstathiou N, Vanderspank-Wright B, Ufholz L-A, Dütthorn N, Zimansky M, et al. The use of Delphi and nominal group technique in nursing education: a review. Int J Nurs Stud 2016;60:112–20.
[16] McMillan SS, King M, Tully MP. How to use the nominal group and Delphi techniques. Int J Clin Pharmacol 2016;38:655–62.
[17] Edgar L, McLean S, Hogan SO, Hamstra S, Holmboe ES. The milestones guidebook, Accreditation Council for Graduate. Med Educ 2020:6–19.
[18] Kaplan-Liss E, Lantz-Gefroh V, Bass E, Killebrew D, Ponzio NM, Savi C, et al. Teaching medical students to communicate with empathy and clarity using improvisation. Acad Med 2018;93(3):440–3.
[19] Bachmann C, Pettit J, Rosenbaum M. Developing communication curricula in healthcare education: an evidence-based guide. Patient Educ Couns 2022;105(7):2320–7.
[20] Thistlethwaite J. Interprofessional education: a review of context, learning and the research agenda. Med Educ 2012;46(1):58–70.
[21] Hoffmann-Longtin K, Rossing JP, Weinstein E. Twelve tips for using applied improvisation in medical education. Med Teach 2018;40(4):351–6.
[22] Mehta A, Fessell D. Improvisation in the time of a pandemic: field notes on resilience. J Grad Med Educ 2022;14(1):13–7.
[23] Neel N, Maury JM, Heskett KM, Iglewicz A, Lander L. The impact of a medical improv curriculum on wellbeing and professional development among pre-clinical medical students. Med Educ Online 2021;26(1):1961565.
[24] Shochet R, King J, Levine R, Clever S, Wright S. 'Thinking on my feet': an improvisation course to enhance students' confidence and responsiveness in the medical interview. Educ Prim Care 2013;24(2):119–24.
[25] Parmelee D, Michaelsen LK, Cook S, Hudes PD. Team-based learning: a practical guide: AMEE guide no. 65. Med. Teach. 2012;34(5):e275–87.