

RESEARCH ARTICLE

Developing pharmacy students' soft skills by combining graphic medicine and role-playing simulations: A mix-method study

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Abstract

Background: This study aimed to develop and assess a new active pedagogy module combining reading a graphic novel on bipolar disorder and simulation training to increase empathy, communication, and emotional intelligence among pharmacy students. **Methods:** A mixed-method approach combined reading the graphic novel "A Fox in My Brain" by Lou Lubie, focused on bipolar disorder, with role-playing exercises. Empathy was measured, pre- and post-intervention, using the Jefferson Scale of Empathy - Health Professions Student version (JSE-HPS) and the Interpersonal Reactivity Index (IRI). Students also completed questionnaires on satisfaction, perceived benefits, and bipolar disorder knowledge, and participated in focus groups for qualitative feedback. **Results:** Increases were observed in empathy scores, especially in Perspective Taking and Compassionate Care. Most students felt better prepared to support bipolar patients, with 94% finding the graphic novel relevant to their future practice. High success in knowledge assessment and positive qualitative feedback indicated the emotional impact and practical value of this educational approach. **Conclusion:** Combining graphic medicine and simulation training into pharmacy education appears to support the development of important soft skills that are relevant for patient-centred care. By engaging students emotionally and intellectually, this integrated approach strengthens their preparedness for empathetic patient interactions. It also enriches pedagogical engagement and encourages the diversification of learning methods.

Introduction

The importance of soft skills – such as empathy, emotional intelligence, communication, and critical thinking – has long been recognised as essential for fostering strong relationships between patients and healthcare professionals (Hojat, 2016). Numerous benefits have been linked to the development of these skills, particularly empathy: increased patient satisfaction and adherence to therapy (Flickinger *et al.*, 2016), improved clinical outcomes, and enhanced personal well-being among healthcare professionals (Flickinger *et al.*, 2016; Lafleur *et al.*, 2019). For pharmacists, the need to cultivate soft skills is

especially critical in providing patient-centred care. As professionals who advocate for the proper use of treatments, pharmacists build relationships with their patients that significantly influence treatment compliance and overall patient adherence (Bell *et al.*, 2016; Ilardo & Speciale, 2020). Therefore, excellent communication is of utmost importance.

However, research has shown that empathy tends to decline among medical students as they progress through their studies (Neumann *et al.*, 2011; Triffaux *et al.*, 2019; Walker *et al.*, 2022), negatively affecting both their mental well-being and clinical performance. This decline highlights the growing recognition of the need to implement educational modules that enhance

soft skills in medical students (Jeffrey, 2019; Marini, 2016; Patel *et al.*, 2019). In recent years, various educational interventions have been developed to address this need, including high-fidelity simulation training, role-playing, simulated patient interactions, virtual reality training, patient narratives, and the use of creative arts (Bagacean *et al.*, 2020a; Garza *et al.*, 2023; Gaspar, *et al.*, 2024; Mesquita *et al.*, 2010; Zhou *et al.*, 2021).

Role-playing, in which learners develop skills in a safe environment, has proven to be an effective method for teaching soft skills such as patient communication (Bagacean *et al.*, 2020b; Cansever *et al.*, 2015; Gaspar, *et al.*, 2024). This approach allows participants to practice empathy, active listening, and clear communication without fear of real-world consequences. By simulating patient interactions, learners can experiment with different techniques and receive immediate feedback, leading to deeper learning and increased confidence in handling sensitive patient scenarios.

Among the various educational tools used to develop soft skills, narrative medicine education uses storytelling and personal narratives to enhance understanding of illness and patient experiences (Milota *et al.*, 2019). Graphic medicine is a subcategory of narrative medicine and employs visual storytelling (comics and graphic novels on health-related topics) to address these illnesses and patients' experiences. Its specificity lies in the combination of visual and textual storytelling. The use of images allows for nuance in emotion, body language and non-verbal communication. By combining the explicit meaning of words with symbolic and abstract visuals, this medium offers readers a more approachable way to engage with complex medical topics, while also fostering an emotional connection to personal health narratives (Al-Jawad, 2015; La Cour & Poletti, 2022; Marini, 2016; Milota *et al.*, 2019).

Graphic medicine has gained increasing prominence in higher education (Consorti *et al.*, 2023; De Stefano *et al.*, 2023; Diedrich, 2022; Green, 2013; Green & Myers, 2010; Maatman *et al.*, 2022; Ronan & Czerwicz, 2020). A growing body of research demonstrates that both reading and creating graphic medicine can benefit not only patients (De Stefano *et al.*, 2023; Green & Myers, 2010) but also students (e.g., medical undergraduates, nursing students) (Adamidis *et al.*, 2022; Green & Myers, 2010; Levett-Jones *et al.*, 2024; Tsao & Yu, 2016) and healthcare professionals (e.g., physicians, nurses) (Joshi *et al.*, 2019; Ronan & Czerwicz, 2020; Saltzman, 2023) by enhancing their understanding of living with specific illnesses and improving key soft skills such as empathy and communication.

Specifically, both Hoffman and colleagues (Hoffman, 2023) and Muzumdar and colleagues (Muzumdar, 2016) have emphasised the need for, and advantages of, incorporating graphic medicine and narrative approaches specifically into pharmacy curricula. Two studies have explored the application of narrative medicine education in pharmacy academic cursus by developing workshops that used patient narratives in various forms (e.g., poetry, texts, videos, novels) (Graabaek *et al.*, 2024; Han *et al.*, 2024). Both studies reported positive feedback from participants, underscoring the potential of these tools to enrich pharmacy education. Finally, Graabaek and colleagues (Graabaek *et al.*, 2024) applied narrative-based courses for community and hospital pharmacists, demonstrating an increase in empathy scores.

While simulation training and narrative medicine (including poetry, texts, videos, and novels) have been developed and studied as tools to enhance soft skills in pharmacy students, and graphic medicine has been studied for medical students, the use of graphic medicine for pharmacy students has, to our knowledge, not yet been evaluated. The main objective of this project was therefore twofold to develop a specialised educational module for pharmacy students, integrating the reading of a graphic novel to develop soft skills (specifically empathy and communication), by quantitatively and qualitatively assess the impact of this module on students' soft skills. A secondary objective was to explore, on a small scale, the transferability of the competences acquired using the graphic novel, by means of a simulation-based sequence.

Materials and methods

Study design

A mixed-method approach was employed in this study, consisting of 1) a quantitative study measuring empathy before and after reading a graphic medicine comic on bipolar disorder, which was created in collaboration with a clinical psychologist and includes theoretical information on bipolar disorder (A Fox in My Brain by Lou Lubie, French version) (Lubie & Leygnac-Solignac, 2021), 2) a qualitative study based on focus groups organised after reading the comic, and 3) a qualitative study based on focus group organised after simulation training and role-playing following the reading.

This study was approved by the Ethics Committee for Clinical and Non-Clinical Faculties at the University of Liège, reference: 2021/402.

Participants

The target population included students in the final year of the master's program in pharmacy over two academic years: 2021-2022 (n = 40) and 2022-2023 (n = 61). Final-year master's students were selected because half of their curriculum involves professional training. A total of 101 students participated in the reading part of the study, and a sample of 55 students participated in the post-reading focus group. For the simulation component, 71 students took part in the simulation activity, and a sample of 50 students participated in the post-simulation focus group. Demographic data could be provided by the Collection and Analysis of Data and Information of Strategic Value department (RADIUS) at the University of Liège.

Empathy and outcome measurement

To measure empathy, two scale of empathy were used: the Jefferson Scale of Empathy- Health Professions Student version (JSE-HPS) (Hojat *et al.*, 2018) and the Interpersonal Reactivity Index scale (IRI) (Davis, 1983). Both scales were completed by students before (pre-reading questionnaire) and after (post-reading questionnaire) reading the comic, with an online form.

The JSE-HPS measures empathy in healthcare students, focusing on patient-centred care. The JSE-HPS consists of 20 statements accompanied with a 7-point Likert scale (1 = Strongly Disagree to 7 = Strongly Agree). A higher JSE total score indicates a higher level of empathy. It measures three factors: (1) Perspective Taking, (2) Compassionate Care and (3) Standing in the Patient's Shoes.

The IRI scale assesses multidimensional empathy across cognitive (Perspective Taking) and emotional (Empathic Concern, Personal Distress) domains in various interpersonal contexts. The IRI consists of 28 statements accompanied with a 5-point Likert scale (1 = Does not describe me well to 5 = Describes me very well). The IRI scale is divided into four subscales: (1) Perspective Taking, (2) Fantasy, (3) Empathic Concern and (4) Personal Distress. The IRI was developed to measure empathy across these four distinct dimensions rather than as a single construct.

For both empathy scales, the mean total and subscales scores and standard deviation were calculated after reverse-coding the negatively worded items and then compared. In addition, comparisons of empathy scores observed before and after the reading were conducted using paired *t*-test or Wilcoxon test (after running Shapiro-Wilk test to determine the distribution normality). A *p*-value of 95% ($p < 0.05$) was set as significant. 95% CIs and effect size (using Cohen's *d* or *r* test) were also calculated. All data were statistically analysed using JASP software (JASP Team, 2025).

In addition to the two empathy scales, participants were asked to respond to specific questions about their feelings (10 questions) and knowledge (nine questions) regarding bipolar disorder to assess whether they felt more confident about the disorder after reading the comic. These items were designed by the authors and were not formally piloted prior to data collection. They reflect a cross-sectional assessment of knowledge performance, as well as an evaluation of students' feelings and attitudes toward the reading activity. The specific questions asked to the participants can be found in Table I.

Table I: Satisfaction, perceived benefits and knowledge questions after reading the comic

Satisfaction and perceived benefits questions	No	Yes	I don't know
Before reading, did you feel competent in the topic of bipolarity?	78%	17%	5%
Do you feel more competent now?	15%	80%	5%
Did you learn anything that will be useful in the future?	3%	94%	3%
Did reading a graphic novel to learn about bipolarity seem appropriate?	1%	97%	2%
Do you feel better able to understand this type of illness?	4%	91%	5%
Do you feel more empathetic towards people with bipolar disorder?	10%	86%	5%
Would you recommend this type of reading to a colleague?	0%	95%	5%
Should this activity be carried out more frequently? (reading other graphic novels)	5%	86%	10%
Do you feel more competent and able to listen to a patient with bipolar disorder who comes into the pharmacy?	7%	90%	3%
Should this type of activity take place at least once during the Master's programme (or more often)?	3%	94%	3%

Knowledge questions	No	Yes	I don't know
Are there different forms of bipolarity?	0%	100%	0%
Can a bipolar person have depressive episodes?	0%	100%	0%
Bipolar treatment lasts only a few weeks or months.	99%	1%	0%
The bipolar person is simply crazy.	99%	1%	0%
In a manic phase, the bipolar person doesn't feel the need to sleep.	10%	83%	8%
Lithium is one of the treatments for bipolar disorder.	0%	99%	1%
Bipolar patients are at real risk of suicide.	0%	96%	4%
A bipolar patient can become pregnant with any bipolar treatment.	92%	2%	6%
Bipolar patients are more likely to develop addictions.	5%	83%	13%

Post-reading focus group

A qualitative method was employed to enable deeper interpretations of the obtained quantitative data, exploring the impact of reading the graphic novel. Participants were invited to join a face-to-face semi-structured focus group (FG) to discuss their experiences on a voluntary basis. Out of the 101 readers, 55 participants accepted to take part to the FG and were interviewed by Dominique Thewissen using open exploratory questions developed by two other authors (Marjorie Bardiau and Aurore Gaspar).

Thematic analysis was conducted following Braun and Clarke's six-step framework (Braun and Clarke, 2006) based on participants' responses to the interview guide (Appendix A). The process of thematic analysis included: 1) familiarisation with the data (researchers immersed themselves in the data by reading and re-reading responses to gain a comprehensive understanding), 2) generating initial codes (data were systematically coded using open coding, capturing key ideas and expressions), 3) searching for themes (codes were examined to identify patterns or themes, grouping similar or related codes together), 4) reviewing themes (themes were refined to ensure consistency and relevance across the dataset), 5) defining and naming themes (each theme was clearly defined and named to reflect its core meaning), 6) producing the report (themes were integrated into a coherent narrative supported by illustrative quotes from participants).

Simulation training using role-playing and post-simulation focus group

A seminar incorporating simulation training with role-playing exercises was conducted after the reading of the graphic novel and the FG, alongside participants' internships in community pharmacies. The main objective of this training was to evaluate the perception

of the transferability of the developed skills, on a small scale.

The objectives of the simulation were as follows: (1) to explore the complexities of patient communication, with a focus on perceiving patients' emotions and adapting counselling accordingly; (2) to learn how to adjust medication recommendations and advice based on specific situations, such as the introduction of new treatments, the occurrence of adverse effects, or a patient's intention to conceive; (3) to promote the transfer of newly developed skills into practice.

The simulation was conducted in accordance with INACSL standards of best practice and addressed gaps identified in simulation training for pharmacy students, as highlighted in the literature (Gaspar, et al., 2024; McDermott et al., 2017).

The educational framework for this activity was based on Kolb's experiential learning cycle, emphasising learning through concrete experiences, reflective observation, conceptualisation, and active experimentation (Sternberg & Zhang, 2001). In this model, simulation served as the active experimentation phase of Kolb's cycle: the patient—the heroine of the graphic novel—was portrayed by an actor skilled in improvisation.

The pharmacist-patient interactions focused on issues relevant to bipolar disorder, with scenarios covering themes such as pregnancy and bipolarity, advice on stopping medication, and more.

Debriefing, essential for learning, centred on analysing the pharmacist's actions and attitudes in patient care (Shinnick M et al., 2011). A tailored debriefing framework, inspired by the method of debriefing with Good Judgement or debriefing with facilitated discussion and recent debriefing models (Bomhof-Roordink et al., 2019; Gaspar, et al., 2024), was developed specifically for this simulation. This method considers mental models ("frames") of the participant

(knowledge, assumption, feelings) that led them to act during the simulation and to perceive an element of the patient/pharmacist interaction as positive or negative. Students were encouraged to observe the impact of actions taken by their peers in the role-playing scenarios and the resulting outcomes on the simulated patient.

Results

Participants description

One hundred and one students took part in the study, read the comic and completed the pre- and post-reading questionnaires and 55 students participated in the focus group (FG) post-reading on a voluntary basis. Out of the 101 students, 71 students took part to the simulation training and, out of the 71, 50 participated to the focus group (FG) post-simulation on a voluntary basis.

Out of the 101 total participants, 81.2% were women and 18.8% were men. Although women were overrepresented compared to last-year students across all sections (60.6% women and 39.4% men during the same period), the gender composition of this participant group was representative of the population of last-year pharmacy students over the past five academic years (2019 – 2020 to 2023 – 2024), with a five-year average of 81.59% women and 18.41% men (standard deviation: 3.26%). The mean age of participants was 23.45 years, with 89.4% between 21 and 25 years old. This is representative of last-year students across all sections (including pharmacy), whose mean ages were 23.96 and 23.68 years, respectively. No additional data could be provided due to the university’s regulations.

Quantitative study: Empathy evolution

Empathy scores were measured before and after reading the comic using two scales: the JSE-HPS and IRI test. The results are presented in Table II and Figure 1.

Table II: JSE-HPS and IRI scores pre- and post- reading the comic (mean, standard deviation (SD), test of normality using Shapiro-Wilk test (Normality), statistical tests (paired t-test or Wilcoxon) and p-value, effect size (Cohen d or r) and 95%CI for effect size (95%CI ES), n = 101)

JSE-HPS	Perspective taking		Compassionate care		Standing in the patient’s shoes		Total	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	54.7	56.5	46.5	47.5	8.0	7.4	109.2	111.4
SD	7.7	9.3	4.8	6.2	2.4	3.1	10.4	11.9
Normality	0.978 (p = 0.083)		0.966 (p = 0.011)		0.962 (p = 0.005)		0.986 (p = 0.364)	
Test	Paired t-test		Wilcoxon		Wilcoxon		Paired t-test	
p-value	P = 0.038		P = 0.022		P = 0.039		P = 0.034	
Effect size	- 0.209		- 0.279		0.261		- 0.214	
95%CI ES	[-0.406, -0.011]		[-0.481, -0.048]		[0.018, 0.475]		[-0.411, -0.016]	
IRI	Perspective taking		Empathic concern		Personal distress		Fantasy	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean								
SD	17,4	19,0	20,3	20,8	15,8	16,0	18,3	19,1
Normality	4,4	4,4	5,2	4,5	5,1	5,3	6,1	6,5
Test	0.961 (p = 0.004)		0.960 (p = 0.004)		0.988 (p = 0.468)		0.981 (p = 0.141)	
p-value	Wilcoxon		Wilcoxon		Paired t-test		Paired t-test	
Effect size	p < 0.001		p = 0.106		p = 0.604		p = 0.20	
95%CI ES	[-0.688, -0.358]		[-0.418, 0.041]		[-0.247, 0.144]		[-0.432, -0.036]	

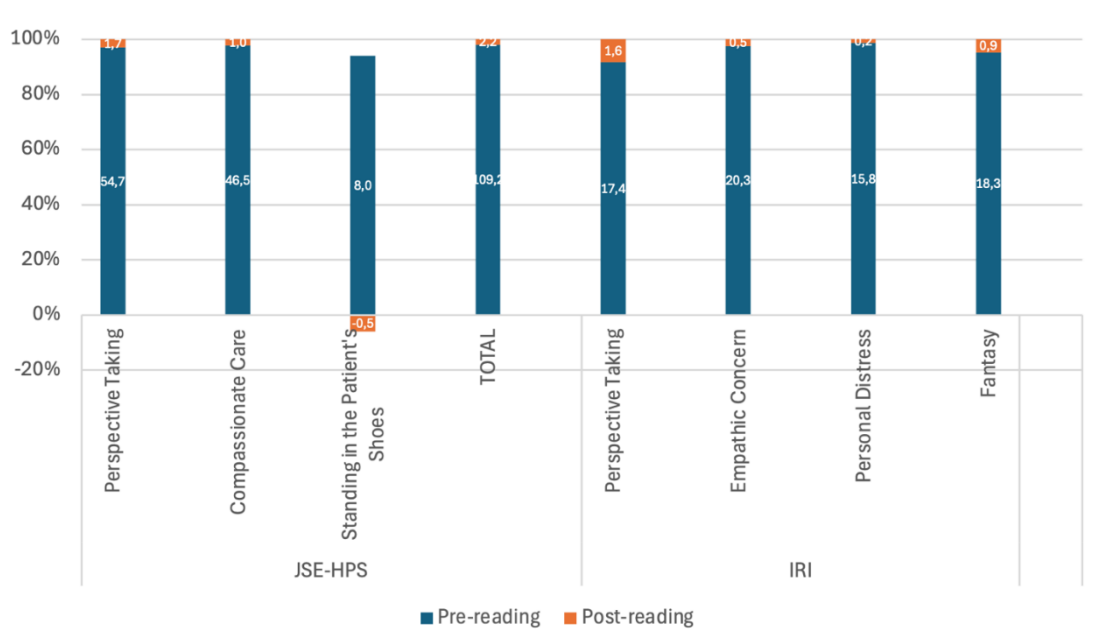


Figure 1: JSE-HPS and IRI absolute scores pre- (in blue) and post- reading (in orange) the comic (n = 101)

Briefly, the total empathy score on the JSE-HPS before reading the comic ranged from 84 to 129, with a mean of 109.2 ± 10.4 . After reading the comic, the total score rose significantly ($p < 0.05$) to 111.4 ± 11.9 , with two of the three empathy components—Perspective Taking ($p < 0.05$) and Compassionate Care ($p < 0.05$)—showing a statistically significant increase, while the Standing in the Patient's Shoes component significantly decreased ($p < 0.05$). The analysis revealed that the effect size was small. Two specific questions showed an observable increase in their scores, both regarding the importance of patient emotions in the patient-health professional relationship.

For the IRI score, all empathy dimensions increased following the reading, with Perspective Taking showing the largest improvement. Among the four subscales, two – Perspective Taking ($p < 0.001$) and Fantasy ($p < 0.05$) – demonstrated statistically significant changes, with respectively medium and small effect size. Additionally, specific items in the questionnaire showed notable increases. First, questions related to seeing things from another's perspective saw observable gains. Second, within the fantasy dimension, scores for questions about the fascination and captivation with fictions and fictional characters increased markedly.

Quantitative study: Satisfaction, perceived benefits and knowledge assessment

In addition to completing the IRI and JSE-HPS empathy assessments, participants responded to two additional

questionnaires: one on their satisfaction and perceived benefits, and another on their knowledge of bipolar disorder.

Satisfaction and perceived benefits were evaluated through ten questions (Table II). Students felt generally more competent on the topic of bipolarity after reading the comic (17% felt competent before, compared to 80% after), particularly in the context of professional pharmacy settings. Specifically, 94% of the students believed the comic would be useful for their future careers, and 90% felt more competent and better able to listen to bipolar patients in the pharmacy. In overall, 91% felt more capable to understanding the illness and 86% more empathetic towards bipolar patients. When asking about the relevance of this type of activity for students, 97% of the participants thought that reading a comic to learn about bipolarity was appropriate, 86% believed this type of activity should be conducted more frequently and 94% felt it should be included at least once during the master's programme. Finally, 95% of participants would recommend this type of reading to their peers.

As A Fox in My Brain was created in collaboration with a clinical psychologist and includes theoretical information on bipolar disorder, participants' knowledge of the disorder was assessed after reading the comic through nine theoretical questions (Table II). The success rate for these questions was very high, ranging from 83% to 100%.

Qualitative insights from the focus group on reading a graphic medicine comic

Thematic analyses reported five main themes based on 16 codes.

Perceived pedagogical value and engagement

Most students supported this type of activity (reading a graphic medicine comic) and felt it should be used more frequently with other topics. They recognised the strong educational value of this approach, noting that it reinforced knowledge and fostered active learning of both concepts (knowledge) and practical skills (know-how). Importantly, the format did not add extra work for students—the workload was manageable, and the content was accessible, educational, and engaging. One student reflected, *'Discussing it afterward felt refreshing, as it's not the typical type of pedagogy we experience at university'*.

Emotional engagement and empathy development

This active learning strategy was designed to promote a deeper understanding of interactions with a bipolar (cyclothymic) patient. One student reflected, *'It's a form of active learning because we're not only learning but also connecting emotionally—it's more concrete, and the emotional component really helps with memory'*. Another student shared, *'I sometimes felt like I wasn't just in her [L. Lubie's] shoes but actually right by her side.'* Similarly, some felt sensitive to the patient's distress while reading.

Deepening understanding of mental health

After engaging with the material, students reported moving beyond a simplistic or 'cliché' understanding of the disorder, gaining a greater appreciation for its complexity. They felt they now understood bipolarity and the patient's experience more fully and would be more attentive to the patient's needs.

Transferability to simulation before professional practice

The empathy and skills developed were directly applicable to pharmacy practice. One student reported *"Simulation will allow us to consolidate on what we already had an idea of, to have an idea of popularisation and so it was productive."*

Recognition of limits and need for further training

Although students reported feeling more empathetic and prepared to engage with bipolar patients, they also expressed uncertainty about the specific communication strategies to use in these interactions.

Students' feedback highlights their desire for further training, especially through simulations, to address these remaining uncertainties and strengthen their skills. *"We had some knowledge from reading the comic book, but did we have the skills to tell the patient what to do before the simulation? Not necessarily!"*

Quantitative insights from the focus group on simulation training after reading a graphic medicine comic

Thematic analyses reported five main themes based on 17 codes.

Learning through action and safe experimentation

Students identified two main strengths in this type of activity: stepping outside their comfort zone without facing direct risk and engaging in learning through action. The exercise enabled students to test their skills, experiment with intuition, and receive feedback from both peers and the scientific referent, helping them gauge their own competence.

Development and transferability of professional skills

Students noted that some of the skills developed during the bipolar disorder simulation are transferable to other contexts, making them feel better prepared to handle different challenges as a result of this exercise. They expressed that integrating simulations into their curriculum could help them establish practical skills through hands-on experiences even before starting their internships. Following the reading, the simulation exercise allowed them to further deepen their understanding of the pathology and reinforce their knowledge for future practice. Finally, all students felt that this exercise provided insights that would be valuable for their future careers.

Self-assessment and awareness of competence

One student shared, *'That's where you really see the importance of practice... yesterday, when you asked about my response after reading the book, I was so eager to do the role-play because I thought, "Yeah, I can handle this." ... But I was too confident and when I was actually behind the counter, I realised—it's not that easy!'*

Emotional regulation and supportive learning climate

While they felt better equipped to understand the disease (compared to after just reading the graphic novel), they did not feel that the simulation enhanced their empathy further. Unlike their experience with the graphic novel, students reported no negative emotions

during the simulation. Instead, they felt reassured and especially appreciated the supportive nature of the group, which reinforced their belief in the value of this type of exercise.

Role of debriefing in reflection and learning integration

Students highlighted the debriefing process, as it allowed them to focus on the interactions without the need for notetaking, which was handled by the instructor. During the debriefing, the group discussed the timeline of the interactions and the effects of the simulated pharmacist's attitudes. The supportive environment during both the simulation and debriefing sessions was especially appreciated, as it helped students feel confident and engaged throughout the learning experience.

Discussion

This study aimed to explore the use of graphic medicine as an educational tool for pharmacy students, a method previously unexamined in this context. In addition, simulation training has been added to explore the perception of the transferability to practice, for a fewer number of students. While simulation training and graphic medicine have individually been shown to enhance soft skills in pharmacy and medical students respectively, their combined impact had not been evaluated.

The results of this study highlight the potential of using a graphic medicine comic to enhance empathy and knowledge among pharmacy students. The quantitative data indicate a modest but notable statistically significant increase in empathy scores and most subscales as measured by the JSE-HPS and IRI scales. Although statistically significant, effect size data showed that these effects remain limited in practical terms, implying that the reading exerts only a modest influence on empathy. Specifically, the JSE-HPS scores showed a slight significant increase in the components of Perspective Taking and Compassionate Care, while the Standing in the Patient's Shoes component remained relatively unchanged. This suggests that while the comic was effective in enhancing certain aspects of empathy, it may not have fully addressed the experiential component of empathy. The IRI scores demonstrated improvements across all dimensions, with Perspective Taking and Fantasy showing statistically significant gain. This aligns with the qualitative feedback from students, who reported a deeper understanding of bipolar disorder and a greater ability to empathise with patients. The specific increases in certain IRI questions further

support the effectiveness of the comic in fostering empathy. These results align with those obtained on other medical students or professionals (Tsao & Yu, 2016).

The satisfaction and perceived benefits questionnaire revealed that students felt more competent in understanding and managing bipolar disorder and patients after reading the comic. The high percentage of students who believed the comic would be useful in their future careers and felt more competent in listening to bipolar patients underscores the practical value of this educational tool. The positive response to the relevance and frequency of such activities suggests that integrating graphic medicine into the curriculum could be beneficial for learning and allow for diversification of learning methods. Furthermore, Kolb's model accommodates some different learning styles. It might be particularly suitable for students who prefer to learn through hands-on experience.

The knowledge assessment showed high success rates on theoretical questions about bipolar disorder, suggesting that the comic effectively conveyed information, particularly as the participants had not received any formal teaching on the disease itself during their curriculum. These results should, however, be interpreted with caution, as participants' initial knowledge could not be assessed beforehand. Although the initial knowledge levels of participants were not measured, they reported feeling more competent on the topic afterwards, suggesting that the understanding on bipolar disorder had increased. Participants also highlighted the link they could do with their theoretical course such as pharmacology in which they learned a few notions on the treatments and medications used for bipolar disorder.

Qualitative insights from the focus group discussions after reading the graphic novel provided additional context to the quantitative findings. Students appreciated the active learning approach and felt that the emotional engagement facilitated by the comic helped reinforce their learning. The feedback highlighted the importance of connecting emotionally with the material to enhance memory and understanding, as already shown (Immordino-Yang & Damasio, 2007).

The simulation training reinforced the practical application of the communication skills developed through the comic-based activity. As demonstrated by Chen et al., simulation is an effective method for translating acquired knowledge and skills into real-world patient care (Chen *et al.*, 2008). Students appreciated the opportunity to step outside their comfort zones and engage in experiential learning within a safe environment, free from direct risk. The perceived transferability of these skills to other professional

contexts suggests that such simulations can effectively prepare students for a range of real-life challenges. The supportive atmosphere during the simulation and debriefing sessions was particularly valued, as it fostered confidence and active engagement – key factors known to enhance learning (Bandura, 1997).

The focus group findings underscored the value of the phased educational approach – beginning with the reading of a graphic novel, followed by a simulation-based role-play – and the synergy between these two components. The comic helped students develop essential soft skills such as empathy and active listening, while the simulation offered a safe environment to practise these skills and adopt appropriate behaviours when interacting with patients with bipolar disorder (e.g., identifying terminology to avoid). Students reported a perceived transfer of these skills to clinical practice, along with their potential relevance in broader healthcare contexts.

Empathy-focused educational strategies have been widely documented in the literature across pharmacy and other healthcare disciplines (Batt-Rawden *et al.*, 2013). This study brings a novel approach by combining graphic medicine with simulation, offering a unique opportunity to explore skills transfer into professional practice. Nevertheless, it presents several important limitations that should be addressed. First, the absence of a control group makes it difficult to attribute changes in empathy directly and solely to the intervention. Second, the use of a single graphic novel focused on bipolar disorder may have influenced student responses due to its specific artistic style and the emotional sensitivity of the topic. These factors could have affected how students engaged with the material.

Empathy scores showed only modest improvements, and notably, the “*standing in patient’s shoes*” component slightly declined, suggesting that the experiential dimension of empathy may not have been fully addressed. The study population—pharmacy students from the University of Liège, predominantly women—is not representative of broader student groups or practicing pharmacists, limiting the generalisation of the findings.

Additionally, knowledge was assessed only after the intervention, preventing comparison with baseline levels. The long-term impact of the activity remains unknown, as students’ increased confidence was measured immediately after the intervention, without many real-world experiences. The full effect would be better evaluated once students are active in professional settings.

Another challenge lies in integrating such interventions into academic curricula, as faculty acceptance and concerns about added workload may hinder

implementation. Collaboration with educators to embed and value these activities is essential for success.

To address these limitations and strengthen future interventions, several recommendations are proposed. These include combining graphic medicine and simulation with structured communication training to better prepare students for patient interactions. Expanding the activity across different years of study, diverse populations, and using varied graphic novels could enhance its impact and help develop soft skills more broadly. Finally, longitudinal studies following students into their professional careers would be valuable to assess the lasting effects on empathy and clinical performance.

Conclusion

In conclusion, the findings demonstrate that integrating graphic medicine into pharmacy education can help to effectively enhance students’ empathy, confidence in communicating with patients, and preparedness for real-world interactions. The high levels of satisfaction and the positive qualitative feedback highlight the impact of this method, while quantitative measures showed slightly statistically significant improved empathy scores. Simulation played a key role in enabling students to explore how such approaches translate into clinical contexts. The integrated nature of the activity – combining reflective reading and experiential practice – was particularly appreciated by students, who reported feeling more confident and competent in patient-centred communication. This holistic learning experience not only conveys theoretical knowledge but also cultivates critical professional behaviours, making it a meaningful addition to pharmacy curricula. Future research should investigate the long-term impact of such interventions on actual patient outcomes and explore their scalability across healthcare education programmes.

Conflict of interest

The authors declare no conflict of interest.

Ethical approval and informed consent

This study was approved by the Ethics Committee for Clinical and Non-Clinical Faculties at the University of Liège.

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Appendix A: Interview guide

Focus group part 1: Reading

Objective: Collect data following a group interview of Master's programme that two students brought together (in groups, separately) to discuss a specific subject (reading the book "Goupil ou face" and exploration of empathy towards patients with bipolar disorder).

THEME A: Did the objectives of this activity (reading a graphic novel) match your expectations?

1. Have you ever read comic book-type books?
2. Have you ever read this type of book (graphic novel dealing with a "Health" theme)?
3. Before reading, did you feel competent in the subject of bipolarity?
4. What did you expect from this reading when you started it?
5. Have your expectations changed during this reading?
6. Do you feel more competent in this area (knowledge of bipolarity) now?
7. Have you learned things that will be useful to you in the future?
8. Did reading a graphic novel to discover bipolarity seem appropriate to you?
9. Was the content of the graphic novel accessible?
10. Will this type of reading help you during your internship?
11. Do you feel more competent to interact with a patient with bipolar disorder who comes to the pharmacy?

THEME B: How do you feel about reading a graphic novel?

1. Did you enjoy reading this graphic novel?
2. Do you feel more able to understand this type of illness?
3. Do you feel more empathetic towards people with bipolar disorder?
4. Did this reading make you feel negative feelings/emotions?
5. Did this reading make you feel positive feelings/emotions?
6. Would you recommend this type of reading to a colleague?
7. After reading this, did you want to put your new skills into practice during a simulation experience (role-play with a simulated patient)?
8. After reading this, did you want to put your new skills into practice during your internship?
9. Do you feel more attentive to a patient with bipolar disorder who comes to the pharmacy?

THEME C

1. Was the framework and structure of this activity adequate?
2. Do you find the time in your reading curriculum of the novel adequate?
3. Should this activity be done earlier?
4. Should this activity be done more frequently? (reading other graphic novels, other themes)
5. Was the workload of this reading appropriate?
6. Did this activity make you want to go further in the search for information on this subject?
7. Should this type of activity be aimed at all purposes or only the pharmacy purpose?
8. Should this type of activity be aimed at several times during the Master's programme?

Focus group part 2: Simulation

Objective: Collect data following a group interview of Master's programme that two students brought together (in groups, separately) to discuss a specific subject (simulation with a patient suffering from bipolar disorder).

THEME A	
1.	Did the objectives of this activity (simulation with a chronic patient) match your expectations?
2.	What did you expect from this activity when it started? Follow-up: were you curious about the theme of this simulation?
3.	Did your expectations change during this activity?
4.	Before the simulation, did you feel competent in the theme of bipolarity?
5.	Do you feel more competent now?
6.	Did you learn things that will be useful to you in the future?
7.	Did the simulation to interact with a bipolar patient seem suitable for a good understanding of a real patient?
8.	Were the scenarios accesible?
9.	Will this type of activity help you during your internship?
10.	Do you feel more competent to interact with a patient with bipolarity who would come to the pharmacy?

THEME B	
1.	How did you feel about the simulation?
2.	Did you enjoy the activity?
3.	Do you feel more able to understand this type of illness?
4.	Do you feel more empathetic towards people with bipolar disorder?
5.	Did this activity make you feel negative feelings/emotions?
6.	Did this activity make you feel positive feelings/emotions?
7.	Would you recommend this type of activity to a colleague?
8.	After this activity, did you want to put your new skills into practice (during your internship, for example)?
9.	Do you feel more attentive to a patient with bipolar disorder who comes to the pharmacy?

THEME C	
1.	Was the framework and structure of this activity adequate?
2.	Do you find the time in your curriculum for this activity adequate?
3.	Should this activity be done earlier?
4.	Should this activity be done more frequently (other simulations with different pathologies)?
5.	Was the workload of this reading appropriate?
6.	Should this type of activity be addressed to all purposes or only the pharmacy purpose?
7.	Should this type of activity be addressed several times during the Master's?