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Meaningful Gamification for Journalism Students to Enhance Their Critical Thinking Skills

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ABSTRACT

Training in critical thinking is essential for the professional development of journalism students. To achieve this goal, this study developed a gamified platform and a blended learning curriculum. During an 18-week experimental instruction period, a series of instructional activities, which included online discussions as well as classroom lectures and discussions, were conducted to enhance 32 journalism students' critical-thinking dispositions and skills. Repeated measure analysis of variance on test scores and analyses of open questions found that the participants significantly improved their critical thinking skills and dispositions through the gamified platform with the experimental instruction in a blended learning environment. The findings suggest that providing clear goals, challenges and quests, feedback, competition and cooperation, actual grading and visible status, access/ unlocking content, onboarding time restrictions, freedom of choice, and new identities and roles, as well as avoidance of over-justification, contributes to achieving a "meaningful gamification" experience, which may further lead to self-determined learning in critical thinking.

KEYWORDS

Architectures for Educational Technology Systems, Computer-Mediated Communication, Improving Classroom Teaching, Postsecondary Education, Teaching/Learning Strategies

INTRODUCTION

It has been suggested that critical thinking (CT), informal logic training, and fallacy training are essential components of journalism education, which contributes to the ideal of democracy in journalism (Herrea, 2012). Both CT and argumentation analysis concerned with fallacies have appeared in the journalism literature (Shoemaker, 2003; Walton, 2007; Stoff, 2008). However, most discussions are focused on various contexts of journalism in America. Looking at curriculum design in China, although CT was first introduced as a learning goal for students in 2001 in Hong Kong, few formal curricula have been developed to achieve this educational objective. CT has been a "null

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curriculum" because most teachers have not received training in how to teach critical thinking (Ou, 2012). Therefore, determining how to introduce and integrate CT into journalism education in China remains a new challenge.

To enhance CT skills and dispositions through one well-designed course is possible (e.g., Yeh, 2012). However, to transform the mindsets of journalism students from rigid to open-minded and to habituate them to CT requires long-term practice. In other words, a training course is only the starting point in enhancing journalism students' CT. To cultivate more professional journalists with great CT, a valid instrument is essential to help them transfer their learning from the classroom into future everyday practices. Gamification refers to the use of game design elements in non-game contexts (Deterding, 2011); it emphasizes the connections between game elements and important aspects of learning (Nicholson, 2012). To date, it is seldom employed in CT training for journalism students. This study thus developed a blended learning curriculum in which concepts of gamification were integrated and a gamified platform was designed to enhance the effects of CT training for journalism students.

CT AND JOURNALISM EDUCATION

Definitions and Elements of CT

In 1990, under the sponsorship of the Committee on Pre-College Philosophy of the American Philosophical Association, a cross-disciplinary international panel of 46 experts yielded a robust conceptualization of CT for the purposes of instruction and educational assessment. In it, CT is defined as follows:

We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based... CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life... While not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon. (APA,1990)

This consensus definition of CT (APA, 1990) not only highlighted the importance of CT but also suggested that CT skills include both cognitive and metacognitive abilities. Similarly, Willingham (2007) claimed that CT consists of seeing both sides of an issue, being open to new evidence that disconfirms your ideas, reasoning dispassionately, demanding that claims be backed by evidence, deducing and inferring conclusions from available facts, solving problems, and so forth.

However, some researchers suggested that CT dispositions should be included as part of CT (Paul, 1990; Esterle, 1993; Yeh, 2012). The disposition toward CT can be defined as the consistent internal motivation to use CT skills to decide what to believe and what to do (Facione, Facione& Giancarlo, 2000). Facione & Facione (1992) proposed the following seven characteristics of a critical thinker and, accordingly, developed the California Critical Thinking Disposition Inventory (CCTDI) (Facione, et al., 2001): (1) truth-seeking: being eager to seek the best knowledge in a given context, being courageous in asking questions, and being honest and objective about pursuing inquiries even when the findings do not support the thinker's self-interests and/or preconceived opinions; (2) open-mindedness: being tolerant of divergent views and sensitive to the possibility of one's own biases; (3) analyticity: prizing the application of reasoning and the use of evidence to resolve problems, anticipating potential conceptual or practical difficulties, and consistently being alert to the need for intervention; (4) systematicity: being organized, orderly, focused, and diligent in inquiries; (5) CT self-confidence: trusting the soundness of one's own reasoned judgments and leading others to rationally resolve problems; (6) inquisitiveness: being intellectually curious and eager for learning even when application of the knowledge is not readily apparent; and (7) maturity of judgment: being judicious in one's decision-making. This study aims to enhance journalism students' CT skills and dispositions.

Argumentation Analysis

CT is typically measured as the ability to identify assumptions, interpret inferences, make inductions and deductions, and evaluate arguments; these skills are typically cultivated via effective communication and problem solving (Yeh, 2012). Accordingly, argumentation is critical to CT. Argumentation is a verbal, social and rational activity aimed at convincing a reasonable critic of the acceptability of a perspective by setting forth a constellation of propositions justifying or refuting the proposition expressed (Eemeren & Grootendorst, 2004). Argumentation theory itself examines "the production, analysis, and evaluation of argumentative discourse" (Eemeren & Grootendorst, 1996, p. 12).

One of the most influential theorists of argumentation has been Stephen Toulmin. Toulmin (1959) proposed a layout containing six interrelated components of analyzing arguments:

1. **Claim:** The conclusion to an argument. For example, if a person tries to convince a listener that he is a Chinese citizen, the claim would be "I am a Chinese citizen";
2. **Grounds:** The facts one appeals to as a foundation for the claim. For example, "I was born in China" can be used as the supporting data for "I am a Chinese citizen";
3. **Warrant:** The statement authorizing one's movement from the grounds to the claim. For example, "a man born in China will legally be a Chinese Citizen" can bridge the gap between the aforementioned claim and the grounds;
4. **Backing:** Credentials designed to certify the statement expressed in the warrant; backing must be introduced when the warrant itself is not convincing enough to the readers or the listeners. For example, if the listener does not deem the warrant in 3 as credible, the speaker will supply the legal provisions as backing, such as "I have a Chinese passport" to show that it is true that "a man born in China will legally be a Chinese Citizen";
5. **Rebuttal:** Statements recognizing the restrictions to which the claim may legitimately be applied. The rebuttal is exemplified as follows, "a man born in China will legally be a Chinese citizen, unless he has betrayed China and has become a spy of another country";
6. **Qualifier:** Words or phrases expressing the speaker's degree of force or certainty concerning the claim. Such words or phrases include "possible," "probably," "impossible," "certainly," "presumably," "as far as the evidence goes," or "necessarily." The claim "I am definitely a Chinese citizen" has a greater degree of force than the claim "I am a Chinese citizen, presumably."

The first three elements ("claim", "grounds'', and "warrant") are considered the essential components of practical arguments, whereas the second triad ("qualifier", "backing", and "rebuttal") may not be needed in some arguments. Nevertheless, Walton (2007) noted that many media arguments such as political speeches, commercial ads and internet blogs are fallacious arguments used as tactics to unfairly get the best of an opponent or deceive a mass audience. By seeing how such arguments work in typical and in problematic cases of mass media persuasion, new light is shed on important and influential techniques of argumentation in communication media (Walton, 2007). This study attempts to incorporate argumentation analyses as well as an introduction to media fallacies into curriculum design and aims to enhance journalism students' CT.

CT and Journalism Education

CT in journalism education is often taught in courses called "Media literacy". In the teachers' materials of "Media literacy through critical thinking", Worsnop (1989) noted several key concepts of CT in media education: (1) all media are carefully wrapped packages; (2) media construct versions of reality; (3) media are interpreted through individual lenses; (4) media are about money; (5) media promote agendas; and (6) developing the ability to analyze, interpret, and evaluate media texts. Beck (2013) also suggested employing the following activities to teach CT skills: (1) prioritizing information; (2) presenting key points in ways that are logical to readers and note what facts are missing; (3) recognizing and separating opinions from facts; and (4) gauging whether sources are credible.

CT skills and argumentation analysis concerned with fallacies have appeared in the journalism literature (e.g., Shoemaker, 2003; Walton, 2007; Stoff, 2008). Herrea (2012) claimed that bringing instruction in CT, informal logic training, and fallacy training into journalism education would contribute to the ideal of democracy in journalism. However, systematic instructional design of CT courses in journalism education (i.e., courses that emphasize how to analyze and evaluate media texts through CT theories) is rarely seen. In this study, we attempted to develop a training course for journalism students in which CT skills, especially argumentation analysis, are introduced and practiced. To achieve a better training effect, a gamified platform was developed to increase the opportunities for practice and interaction.

GAMIFICATION IN CT EDUCATION

Definitions of Gamification

According to Deterding (2011), gamification is the employment of game design elements in non-game contexts. He also proposed the term "situated motivational affordances" and suggested the need to research gamification from the perspective of the connection between affordance theory and self-determination theory (SDT). Situated motivational affordances describe the opportunities to satisfy motivational needs provided by the relation between the features of an artifact and the abilities of a subject in a given situation, which consists of the situation itself and the artifact in its situation-specific meaning and use.

Similarly, Nicholson (2012) introduced the term "meaningful gamification," which emphasizes that connections between game elements and important aspects of learning activities should be presented to help the user make relevant connections between aspects of the non-game activity and his or her own learning goals and desires. Accordingly, a meaningful gamification system in education must encompass a wide variety of users' backgrounds, desires, and skill sets. Moreover, students' situated motivational affordance has to be considered as well.

Gamification in Blended Learning

Gamification refers to the use of game design elements in non-game contexts (Deterding, 2011). In a gamified classroom, teachers may make use of smaller games throughout the unit (Gros, 2015). Game-based learning can be a small component or a descriptor of the entire pedagogical model. Therefore, a gamified course can be more flexible and adaptable than game-based learning in existing learning environments. Gamification can become a "fun layer" that could be plugged into many applications (Monterrat, Lavoué& George, 2013).

Notably, although gaming elements have long existed in the traditional classroom environment, creating a gamified platform for a course is different from applying gaming elements in the traditional classroom and is also different from creating a game for the course. First, a gamified platform allows teachers to teach via a blended learning program that combines both face-to-face classroom methods and computer-mediated activities. Blended learning is a form of curriculum design optimizing the achievement of learning objectives by applying the right learning technologies to match the right personal learning style to transfer the right skills to the right person at the right time (Singh & Reed, 2001). At its simplest level, a blended leaning experience combines offline and online forms of learning, where online learning usually means "over the internet or intranet," and offline learning happens in a more traditional classroom setting. Blended learning can result in radical improvements to the effectiveness, reach and cost-effectiveness of learning programs relative to traditional approaches (Singh& Reed, 2001). In this study, a gamified platform was created to help teachers facilitate the blended learning processes.

Design Principles of Gamification in CT Education

Focused on the design principles of educational gamification design, Dicheva, Dichev, Agre and Angelova (2015) analyzed 34 empirical studies and found that the most commonly used principles in educational contexts are visual status, social engagement, freedom of choice, freedom to fail, and rapid feedback. They further suggested that educational gamification design should include the following principles: (1) Goals: the goals have to be specific, clear, moderately difficult and immediate. (2) Challenges and quests: the challenges have to be clear, concrete, actionable learning tasks with increasing complexity. (3) Customization: personalized experiences, adaptive difficulty, and challenges should be tailored to the player's skill level and increase in difficulty as the player's skills expand. (4) Progress: progression to mastery should be visible. (5) Feedback: immediate rewards instead of vague long-term benefits should be provided. (6) Competition and cooperation: competition and cooperation between individuals or teams should be incorporated; team projects are encouraged. (7) Actual grading: scores of the game should be provided. (8) Visible status: this includes reputation, social credibility, recognition, points, badges, leaderboards, and avatars.

The following principles for educational gamification design are also proposed: (1) Access/ unlocking content: players may not be allowed to access a course component (e.g., supplementary course material) prior to completing the core requirements of a certain course (Iosup & Epema, 2014). (2) Freedom of choice: this includes choices in selecting skill goals and specific challenges to complete, as well as one's order and/or speed in completing the challenges (Dicheva et al., 2015). (3) Freedom to fail: there should be no penalties for poor task performance; revising and re-submitting assignments, or re-taking quizzes, should be allowed (Dicheva et al., 2015). (4) Storytelling: a narrative thread that weaves throughout the game can make the game more engaging and compelling (Kapp, 2012). (5) New identities and roles: the freedom to try different identities and roles should be allowed (Simões, Díaz, & Fernández, 2013). (6) Onboarding time restrictions: onboarding is the "act of bringing a novice into the system" (Zichermann &Cunningham, 2011); a simple technique of starting with "tutorial" game tasks can be incorporated (Iosup & Epema, 2014). (6) Social engagement: players are encouraged to take part in group learning activities and work on team projects; cooperation and interaction with peers is encouraged; both individual and team competitions are provided (Dicheva et al., 2015).

In addition, "meaningful gamification" should be emphasized during instructional design to promote "inner" but not "external" motivation. "Inner motivation" derives from the inherent satisfactions of participating in an activity. When intrinsically motivated, a person is moved to act because of the fun or challenge it entails rather than because of external prods, pressures, or rewards (Ryan & Deci, 2000). On the other hand, "external motivation" is a construct that pertains whenever an activity is done to attain some separable outcome (Ryan & Deci, 2000). It has been suggested that education should foster the internalization and integration of values and behavioral regulations (Deci & Ryan, 1985). However, Deci, Koestner and Ryan (2001) conducted 128 studies and found that most forms of tangible rewards reduced inner motivation. Nicholson (2012) argued that this might imply that once gamification is used to provide external motivation, the user's internal motivation may decrease. To avoid such a decrease, Pagowsky (2012) suggests that the timing of gamification is important; designing rewards to promote the internalization and integration aspects of extrinsic motivation is the next best plan when intrinsic motivation is absent. When rewards are tangible and used to appeal to external motivation only, gamification can be harmful and turn players off to the non-game activity completely. On the other hand, the integration of gamification into education must avoid the "overjustification" effect (Marczewski, 2014). Overjustification happens when a player in a game is not there to learn but rather to stay on the site's list of winners. It usually occurs when an expected external incentive such as money or prizes decreases a person's intrinsic motivation to perform a task (Marczewski, 2014).

Few studies have employed a gamification platform to enhance CT ability. A recent study (Rubin, 2015), which used an online course including gamification activities and 4 CT teaching modules,

showed significant evidence of the development of CT ability. However, this course was taught only online and did not specify whether there was an "over-justification effect". Morris, Croker, Zimmerman, Gill, and Romig (2013) argued that gamification can foster scientific thinking. They defined scientific thinking as encompassing the set of reasoning and problem-solving skills involved in generating, testing, and revising hypotheses or theories. Such scientific thinking skills are the core skills of CT. Morris et al. (2013) claimed that video games can be effective in supporting scientific thinking with respect to scaffolds in three broad domains: (a) motivation: a game/gamification platform can offer curiosity, feedback, praise, flow state and fun failure to the learners; (b) cognition: a game/gamification platform can provide simulation, situating cognition, distributed knowledge, values and identity, and preparation for real-world problem solving for the learners; (c) metacognition: a learner can exercise his/her metacognitive knowledge, metamemory, and metastrategic competence in the game.

To conclude, a gamification platform can be used as a tool to enhance CT. Furthermore, a well-designed gamification platform for enhancing CT skills and dispositions should be able to transition users from a motivation or external motivation to internal motivation and finally, to becoming self-determined learners. To achieve this goal, the aforementioned gamification elements can be incorporated into the platform design for CT instruction. To be noted, not all the elements should be used in the platform at the same time; teachers or designers can employ different elements according to the actual requirements of their teaching activities.

Hypotheses

This study focused on developing a blended CT training course in which a gamification e-learning platform that emphasized the practices of argumentation was employed to enhance journalism students' CT skills and dispositions. The gamification platform was designed based on important principles of the aforementioned elements. Although few studies have investigated the relationship between CT and gamified learning, we proposed the following hypotheses from an exploratory perspective:

1. After the gamification instruction, the participants will improve their CT skills;
2. After the gamification instruction, the participants will improve their CT dispositions.

METHOD

Participants

The participants were 50 senior journalism students who enrolled in the course "Web Literacy" at Nanfang College of Sun Yet-sen University in China. To ensure the training effects, students who skipped the class more than three times and who did not join the discussions of the gamified platform were excluded from the data analyses. In the end, 32 journalism students (6 males and 26 females) participated in this study.

Instruments

The gamified platform "Global Digital Citizens" (GDC) (criticalnews.com.tw) was developed by the researchers. Important gamification elements were integrated into the GDC to gamify the learning processes as well as to enhance the participants' CT skills and dispositions. Detailed explanations are displayed in Table 1; examples of screens are displayed as Figure 1 and Figure 2.

Notably, in addition to incorporating the gamification elements into the GDC, we also designed "the players' manual" to instruct students regarding how to play the game. The rules of the game included: how to win points and how to deduct points from other participants by finding logical fallacies in their arguments. Some explanations of logical fallacies were listed to guide players in judging whether an argument is logical. Hopefully, by reading participants' arguments and checking

Table 1. Gamification elements in the GDC

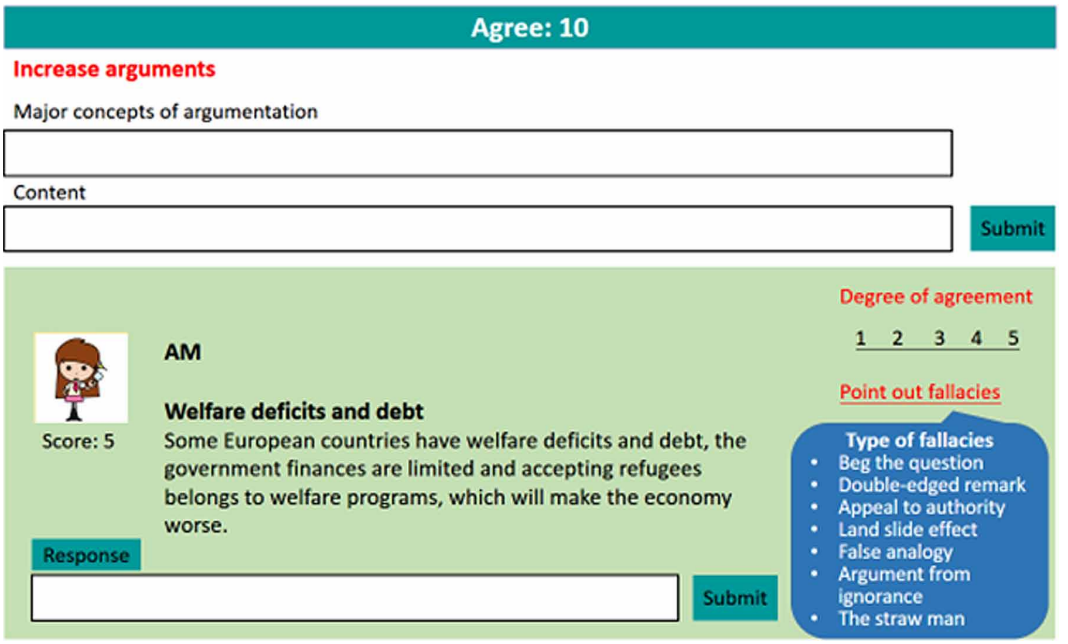
Design in GDC	Relation to CT Skills	Relation to CT Dispositions
2. Goals		
• Participants are encouraged to make fallacy-free arguments and win points from others who like their arguments	• To come up with fallacy-free arguments, participants have to practice CT skills learned in class.	• To achieve the goal, participants have to think analytically and systematically.
9. Challenges and quests		
• Participants have to read the player's manual before starting to play. • Participants are encouraged to interact by challenging others' arguments.	• The player's manual demonstrates the examples of making strong/ good arguments as well as what an argument fallacy is. • Participants can challenge and note others' fallacies of arguments, by which they can gain extra points.	• Mature judgments are required to challenge others' arguments. • During interactions, participants have to seek the truth and be tolerant of divergent views and sensitive to the possibility of their own biases.
10. Feedback		
• Participants get feedback (scores or comments) from peer review.	• Participants can sharpen their CT skills by getting feedback from others.	• Participants have to be open-minded to others' comments and feedback.
11. Competition and cooperation		
• Individual competitions are designed to encourage application of CT skills. • Students are requested to cooperate by posting topics for class discussion. • Group presentation of mind maps based on class discussion and Toulmin's (1959) argumentation model are requested.	• To win top scores, participants have to apply the learned CT skills. • CT skills can be enhanced through the interaction of discussing topics for group posting. • CT skills, especially induction, deduction, and argument evaluation, are essential for developing mind maps.	• Participants with top scores are displayed on the leaderboard to enhance their CT confidence. • Participants have to be open-minded to admit or revise their biases or fallacious thoughts during competitions. • Discussions and development of mind maps provide chances to enhance CT dispositions.
12. Actual grading and visible status		
• Participants get scores immediately. • Participants with top scores are displayed on the leaderboard (See Figure 1)	• To get high scores, participants need to be able to find fallacious arguments as well as to make strong arguments (see Figure 2).	• The scores provide chances for self-reflection or enhancement of CT confidence.
13. Access/ unlocking content and onboarding time restrictions		
• Participants have to pass a short quiz on CT skills before joining the platform.	• Results of the quiz increase participants' self-awareness of what CT skills need to be learned.	• Results of the quiz increase participants' intellectual humility in participating in the learning activities.
14. Freedom of choice		
• Participants can choose any topics they would like to read as well as give scores and comments to any arguments about which they want to give feedback.	• By scanning and deciding which argument to reply to, participants apply their CT skills to a specific topic in which they are interested.	• Through choice of discussion topics and through responding to the arguments they are interested in, participants gradually enhance their dispositions of inquisitiveness.
15. Freedom to fail		
• Participants are allowed to make unsound arguments.	• Participants may make unsound arguments in the beginning but after reflecting on others' feedback, their CT skills are improved.	• This freedom encourages participants to practice CT skills even if they are not self-confident.
16. New identities and roles		
• A new avatar is assigned to the users according to their genders	• This anonymous identity may prevent self-defense mechanisms during interactions and competitions.	• This anonymous identity encourages participation, without users' worrying about being recognized when their arguments are not sound.

the players' manual, the players could gradually enhance their CT skills and dispositions through active learning.

Briefly speaking, the GDC was designed to gradually enhance the participants' intrinsic motivation in learning CT skills and dispositions. Moreover, the GDC was carefully designed to prevent overjustification effects. First, the participants were encouraged, rather than forced, to join the GDC. Second, they were told that they could earn external points at the end of the semester if they performed well on the website. However, the extra points only made up 20% of their final grades.

Figure 1. Top 6 students are displayed on the leaderboard

Figure 2. Instruction for argument fallacies and finding fallacies in an argument. Note: Participants could give preference scores to an argument or gain points by finding fallacies in an argument. Participants who were found to have fallacies in their arguments would lose points.



Third, the GDC was promoted in class at the beginning of the course. However, after participants had transformed their external motivation to a certain level of internal motivation, the GDC was less of a focus in the class.

The Critical Thinking Test, LevelII(CTT-II) was employed to measure the participants' critical thinking skills (Yeh, 2009, 2012). CTT-II consisted of 30 multiple-choice items and was divided evenly into five subsets: assumption identification, induction, deduction, interpretation, and argument evaluation. Each item consisted of one statement and four multiple-choice answers. This test displayed an appropriate level of difficulty and an effective discrimination (discrimination index .35 and difficulty index .58). The subtest scores and total score were significantly correlated: *rs* (492) = .352 to .665, *p*s <. 001 (Yeh, 2009).

The Inventory of Critical-thinking Dispositions (ICTD), a 6-point Likert type scale, was employed to measure the participants' CT-dispositions. The response options were "never" to "always", represented by "1" point through "6" points. The ICTD included four factors: systematicity and analyticity, open-mindedness, inquisitiveness, and reflective thinking. The Cronbach's α for the whole inventory and the four factors were .88, .83, .58, .70, and .63, respectively (Yeh, 1999).

Finally, a reflection questionnaire consisting of 2 open-ended questions was developed by the researcher to evaluate the effectiveness of the gamified platform. The questions included: "Do you think the platform used in this course can enhance your CT ability? Why?" and "Do you have any suggestions regarding this platform?"

Procedures and Instructional Design

To determine whether integrating the gamified platform into the blended learning environment could effectively improve journalism students' CT skills and CT dispositions, an 18-week experimental course was conducted. Pretests and posttests of the CTT-II, SB-CTT, and ICTD were administered in the first and last weeks of the course. The instructional contents covered the classroom lectures and discussions of the following topics: (1) CT; (2) media literacy; (3) Toulmin's argument model; (4) CT skills; (5) argument fallacies; (6) media argument fallacies; and (7) CT strategies. In addition, the participants were asked to join the discussions on the GDC gamified platform after class.

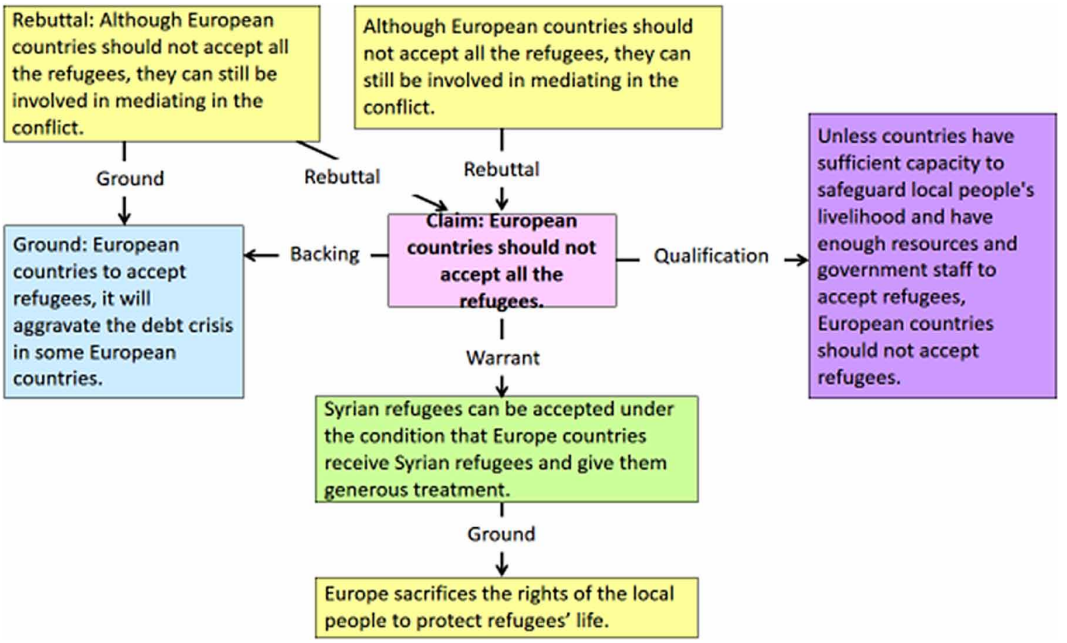
The class was divided into 7 groups based on students' own choices. All groups took turns to upload their topics (self-selected current news) for discussion four days prior to the next class and presented their posted topics on the gamified platform for 30 minutes from week 3 to week 17. After the presentations, all other participants were asked to come up with their own arguments and draw a picture according to the Toulmin (1959) argument model. After half of the semester, participants were further asked to refine their previous topics and to present their argument analyses using mind maps (See Figure 3).

RESUTLS

Improvements in CT Skills

This study employed CTT-II to examine whether the participants improved their CT skills after the experimental instruction. To assess the participants' improvements in different CT skills, a 5 (Factor: assumption vs. induction vs. deduction vs. explanation vs. evaluation) x2 (Test: pretest vs. posttest) Repeated Measure Analyses of Variance was employed. The interaction effect was not significant, Wilks' $\Lambda = .878$, $p = .439$, $\eta_p^2 = .122$. However, both the main effect of CT factors (Wilks' $\Lambda = .208$, $p < .001$, $\eta_p^2 = .792$) and Test (Wilks' $\Lambda = .601$, $p < .001$, $\eta_p^2 = .399$) were significant. The following tests showed that participants (1) performed better in the posttest than in the pretest (Means = 15.469 vs. 17.813); (2) performed better in induction than in assumption identification, $F(1, 31) = 36.027$, $p < .001$, $\eta_p^2 = .538$ and argumentation, $F(1, 31) = 67.241$, $p < .001$, $\eta_p^2 = .684$; (3) performed better in deduction than in explanation, $F(1, 31) = 44.470$, $p < .001$, $\eta_p^2 = .589$ and argumentation, $F(1,$

Figure 3. An example mind map developed based on Toulmin's model

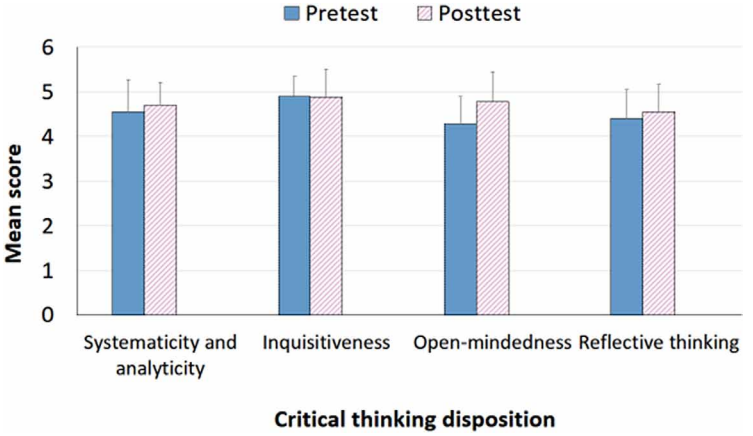


31) = 25.825, $p < .001$, $\eta_p^2 = .454$; and (4) performed better in explanation than in argumentation, $F(1, 31) = 19.305$, $p < .001$, $\eta_p^2 = .384$ (see Figure 4 for Means and SDs).

Improvements in Critical Thinking Dispositions

This study employed the ICTD to measure participants' improvements in CT dispositions. A 4 (Factor: systematicity and analyticity vs. inquisitiveness vs. open-mindedness vs. reflective thinking)x2 (Test: pretest vs. posttest) analysis was employed. The interaction effect (Wilks' $\Lambda = .\ \Lambda = 34$, $p = .004$, $\eta_p^2 = .366$); the main effects of Test (Wilks' $\Lambda = .849$, $p = .025$, $\eta_p^2 = .151$) and Factor (Wilks' $\Lambda = 85$, $p = .001$, $\eta_p^2 = .415$) were also significant. Simple main effect analyses revealed that the participants

Figure 4. Means and standard deviations of different CT skills



performed better in "open-mindedness" than in "systematicity and analyticity", $F(1, 31) = 9.958$, $p = .004$, $\eta_p^2 = .243$, "inquisitiveness", $F(1, 31) = 12.227$, $p = .001$, $\eta_p^2 = .283$, and "reflective thinking", $F(1, 31) = 21.615$, $p < .001$, $\eta_p^2 = .411$. On the other hand, the participants performed better in the posttest than in the pretest on the factors of "open-mindedness", $F(1, 31) = 16.412$, $p < .001$, $\eta_p^2 = .364$ (see Figure 5 for Means and SDs).

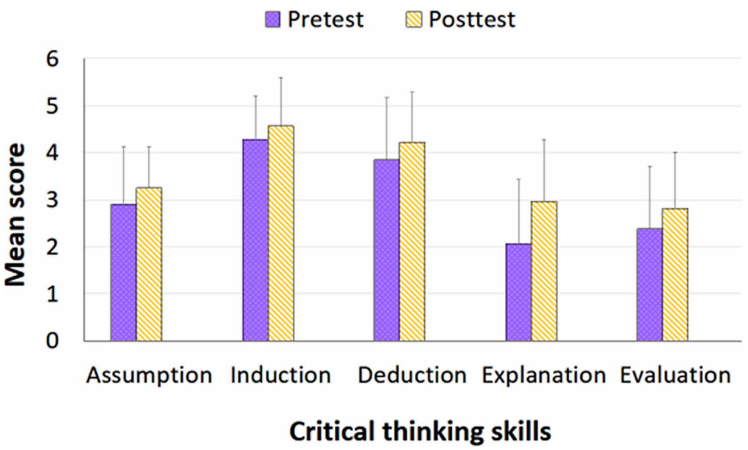
Mechanisms that Contributed to Learning Outcomes

Two reflective questions with regard to the gamified platform and the blended learning experience were employed at the end of the experimental instruction.

Only one participant responded that the gamification platform did not enhance her CT ability because she preferred to study from a book. Thirty-one participants (97%) agreed that the platform contributed to improvements in their CT abilities. Ninety-one percent of the agreed participants mentioned that the platform helped them see different perspectives by sharing and comparing others' posts and comments. The main reasons included: (1) it was quite fun to use the platform because everyone could try to find others' argument fallacies and deduct their points; (2) the combination of entertainment and education helped knowledge acquisition; (3) the cartoon design of the platform was interesting; (4) the little quiz at the beginning of the platform helped explain what to learn in the following classes; (5) the posting of pro and con opinions helped in understanding others' different perspectives and encouraged adjustment of personal opinions; (6) the points gained from the game created motivation to come back to the platform again and to read the player's manual; and (7) posting a response required a thorough analysis of logical arguments.

Twenty-five percent of participants mentioned that they hoped the teacher would discuss the posted contents of the platform more. The other suggestions included (1) "the real person" behind each post might be known so that different perspectives could be discussed in person; (2) set an "online tutor" so to give students immediate feedback; (3) improve objectivity in giving scores because sometimes classmates would give high scores to their good friends; (4) mobile applications (APP) would be a better choice than the platform because they could read the updates from APP at any time; (5) provide more choices regarding the characters; (6) add the function of "group discussion" to the platform; and (7) the platform could be combined with midterm reports (mind map of the Tolumin model) so that the platform could be visualized.

Figure 5. Means and standard deviations of different CT dispositions



DISCUSSION

The results of the Repeated Measure Analyses of Variance as well as the content analysis of the participants' responses in the reflection questionnaire support the hypotheses proposed in this study, suggesting that the instructional design of this study is, in general, effective in improving journalism students' CT skills and dispositions. This study employed two tests (CTT-II and ICTD) as well as open questions to examine whether the participants improved their CT skills and dispositions during the 18-week period of experimental instruction. The analytical results showed that, overall, the participants improved their CT-skills and CT dispositions after the experimental instruction. In this study, students were encouraged to join the gamified platform and to provide input or to respond to other students' arguments after the class. A blended learning environment was included in the design and the teacher helped students to make connections between their gamified experiences and the knowledge gained in the class. The gaming elements of goals, challenges and quests, feedback, competition and cooperation, actual grading and visible status, access/ unlocking content, onboarding time restrictions, freedom of choice, and new identities and roles (Dicheva, Dichev, Agre &Angelova, 2015; Simões et al., 2013; Zichermann &Cunningham, 2011) were incorporated into the gamified platform developed in this study. The effectiveness of the experimental instruction and the responses from the participants in this study not only lend support to past findings but also suggest that these mechanisms are fundamental to improving journalism students' CT skills and dispositions. In addition, the findings support the emphasis that avoiding "over-justification" (Marczewski, 2014) is critical to the success of this study.

More specifically, although the participants' overall CT abilities were improved, they performed better in induction and deduction than in the other CT skills, especially evaluation. The CT skill of evaluation assessed in the CTT-II is actually argumentation evaluation. Argumentation typically requires the integrative application of the other assessed skills, including assumption identification, induction, deduction, and explanation. Accordingly, argumentation is the most complicated and difficult skill among all the assessed CT skills; its slow improvement and low score compared to the other CT skills are thus reasonable. Nevertheless, over 90% of the participants agree that the design of the platform helped them improve their CT skills by finding fallacies as well as sharing and reflecting on the posted arguments. On the other hand, the participants were asked to develop mind maps based on class discussion and the Toulmin (1959) argumentation model; induction and deduction skills are essential during this process. Accordingly, the significant improvement in induction and deduction supports implementing the Toulmin (1959) model and mind maps. Moreover, to know how to play, students often returned to read the players' manual, which helped them to learn critical thinking skills. Therefore, the mechanisms used in the gamification platform in this study, especially those of providing clear goals, challenges and quests, feedback, competition and cooperation, access/ unlocking content, and onboarding time restrictions, are critical for the improvement of journalism students' CT skills.

On the other hand, the participants' overall CT dispositions were enhanced and they showed better performance in inquisitiveness than the other CT dispositions, which suggests that the participants were intellectually curious and eager for learning even when the application of their knowledge was not readily apparent. Moreover, we found that the disposition to open-mindedness showed the most significant improvement. Open-mindedness is critical to self-improvement of CT ability (Facione, et al., 2001). These findings suggest that freedom of choice, feedback, and competition/cooperation provided in the employed platform are critical to facilitating CT dispositions; this analysis is also supported by the responses of the participants in the open questionnaire. For example, a participant responded that "the posting of pro and con opinions helped me understand different perspectives from others and adjust my own opinions". In addition, group discussions and development of mind maps based on class discussion and the Toulmin (1959) model may contribute to enhancing the participants' systematicity, analyticity, open-mindedness, inquisitiveness, and reflective thinking.

Accordingly, our findings suggest that the blended learning model employed in this study contributes to training participants to have a "meaningful gamification" experience and to become self-determined learners. "Meaningful gamification" (Nicholson, 2012) emphasizes that the design of a game does not rely upon external rewards as the sole way to motivate students; rather, the connections between the game elements and important aspects of the activity are presented to help the user make relevant connections between aspects of the non-game activity and his or her own goals and desires.

CONCLUSION

CT is important for the professional development of journalism students. However, the lack of a formal CT curriculum in journalism education is evident. To motivate students to train themselves and to practice their learned skills in everyday life, this study designed a gamified platform to assist with teaching and to promote self-training for students after completing the class. The findings suggest that providing clear goals, challenges and quests, feedback, competition and cooperation, actual grading and visible status, access/ unlocking content, onboarding time restrictions, freedom of choice, and new identities and roles, as well as avoidance of overjustfication, contribute to achieving a "meaningful gamification" experience, which may further lead to self-determined learning.

In this digital age, all audiences can be viewed as prosumers who can consume and produce media at the same time. Undoubtedly, journalists must develop their own professional literacy to distinguish themselves from other prosumers. This study argued that one of the core professional literacies of journalism students should be CT abilities. The gamified platform and the blended learning model employed in this study in China successfully improved journalism students' CT abilities; such a successful experience sheds light on journalism education.

Due to the demands of game development and completion, we did not incorporate additional mechanisms that may contribute to engagement with gamification platforms, such as entertainment, online tutoring systems, online group discussions, more choices of avatars, and a longer discussion period in class. Notably, 25% of the participants responded that the in-class discussion section was not long enough, although the teacher made available the last 30 minutes of each class for students to discuss their posts on the platform. This response indicates that "meaningful gamification" cannot rely solely on the gamification platform itself; it also requires learning activities conducted by a teacher in a classroom setting. Accordingly, when instruction aims to enhance CT ability, blended learning is a better approach than a purely online gamification practice. Suggestions proposed by the participants in this study are valuable: future studies focused on developing gamification platforms should take these suggestions into consideration to attract more journalism students to the learning platform and to encourage students' enjoyment of their learning processes.

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