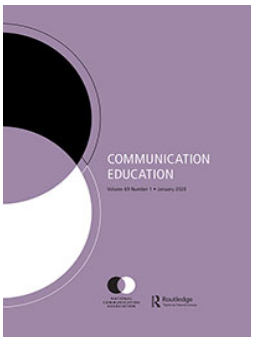

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Student assessment of narrative: telling stories in the classroom

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ABSTRACT

We conducted this study to create a measure of instructional narratives and to validate the new instrument by assessing its construct validity. In particular, we created an item pool reflecting three aspects of instructor-told narratives including their course orientation, concreteness, and memorability. Students ($N = 598$) responded to a series of items measuring the three dimensions of instructional narratives and also their perceptions of instructor clarity, cognitive load, relevance, attention, and both emotional and cognitive interest. Results from exploratory and confirmatory factor analyses revealed that a bifactor model with a general measure of effective storytelling and three subfactors fit the data well. Moreover, the new measure of instructional narratives was related to the educational outcomes noted above in a logical manner and each dimension predicted unique associations with these. In general, our results indicated that in order to teach clearly, explaining course concepts through stories in a manner that students can easily imagine is beneficial. To capture students' attention and emotional interest, stories must be concrete and memorable. Finally, to help students learn, stories must be concrete and course-oriented.

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narratives; storytelling; course-oriented; concrete; memorable; bifactor model

Student assessment of narrative: telling stories in the classroom

The way students process educational information is crucial to their success in various learning endeavors (Bolkan, Goodboy, & Kelsey, 2016). To this point, researchers have argued that one key to instructional effectiveness includes teachers' ability to help their pupils engage in deep-processing and higher-order thinking by using learning strategies that promote elaboration (Dornisch, Sperling, & Zeruth, 2011). That said, researchers who study student information processing in education often emphasize the rational aspects of this behavior (e.g., Bolkan et al., 2016; King, 1992; Ozgungor & Guthrie, 2004) by focusing on cognitive activities that increase the meaningfulness of the information being learned (Levin, 1988). Generally, these activities take the form of higher-order reasoning and include abstract and rule-based information processing (see Evans & Stanovich, 2013 for their description of Type 2 processes). In the classroom, these activities include adding details to what is being learned, clarifying ideas in a lesson, highlighting

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relationships between concepts, or connecting new information to material already learned or to past experiences, for example (King, 1992). Although scholars are inclined to focus on the rational system when studying information processing, this approach to student learning may not encompass all that students do when they think about their course lessons. As several scholars argue, people have two systems that are responsible for information processing; and reflective, deliberate, and conscious elaboration only engages one (Epstein, 2014; Evans & Stanovich, 2013; Norris & Epstein, 2011; Stanovich, 2004).

According to proponents of cognitive-experiential theory (sometimes referred to as cognitive-experiential self-theory), people have two methods for processing information from the environment: the experiential and the rational system (Epstein, 2003, 2014; Norris & Epstein, 2011). Cognitive-experiential theory is one of many dual-processing theories that differentiate between an analytic thinking system (i.e., the rational system) and a heuristic thinking system (i.e., the experiential system; for a sample of dual-process theories in the literature, see Stanovich, 2004). Both systems are assumed to operate together to help individuals learn from and behave appropriately in their environments (Norris & Epstein, 2011). According to Epstein (2003), the experiential system is a learning system that encodes and processes information through associations, past experiences, concrete images, metaphors, and narratives. The rational system, on the other hand, operates using analytical reasoning, evidence, and abstraction.

When it comes to instructional contexts, the focus on information processing usually occurs in the cognitive realm where students have been shown to learn more when they engage in a greater degree of cognitive analysis by making associations between newly acquired information and their current base of knowledge (Craik & Lockhart, 1972). Of course, because humans have two information processing systems, it could be true that teaching to both might prove beneficial compared with focusing on just one. In other words, instead of simply focusing on teaching educational content through the promotion of analytical reasoning, evidence-based thinking, and abstraction, instructors might also benefit students to the extent that they teach course lessons through metaphor, imagery, and narrative. Specifically, by including stories/narratives[1] and cases when they teach (as opposed to sole reliance on abstract principles), instructors can frame learning scenarios within a context and help students develop problem-solving skills (Jonassen & Hernandez-Serrano, 2002). Considering the ability for instructional narratives to influence student learning (Kromka & Goodboy, 2019), it may be beneficial for researchers have a tool to measure this teaching behavior. Thus, the goal of the current study was to create and validate a measure of instructional narratives to help researchers assess the impact of these on various student outcomes.

Experiential processing

Cognitive-experiential theory

As noted in the introduction, people tend to process information using both an experiential/heuristic system and a rational/analytic system (Evans & Stanovich, 2013; Stanovich, 2004). According to Epstein (2014), the rational system processes evidence in a deliberate and logical manner. Moreover, the rational system solves problems based on conscious analytical reasoning (i.e., information is examined through its component parts), is experienced as effortful, and tends to take more time to function when compared with the experiential system. In the rational system, behavior is mediated by conscious appraisals and is organized around abstract concepts. Conversely, the experiential system has implicit beliefs (i.e., schemas, cognitive representations) derived automatically from experience and from associative and observational learning. This system reacts to the environment in a rapid/automatic manner, processes information effortlessly, and creates outputs that are emotional, holistic, and categorical (e.g., approach/avoid, good/bad; Epstein, 2014). The experiential system is sensitive to images, narratives, concrete examples, and metaphors, and comprehends specific examples more readily than it comprehends abstract information (Epstein, 2014). Because information in the experiential system is organized around experiences and concrete representations, this system solves new problems based on knowledge gleaned from similar situations. Because this is the case, narratives are especially appealing to the experiential system because they are emotional, evoke imagery, and reflect concrete events that occur in natural settings (Epstein, 2014).

Though neither system is superior, Epstein (2003) argues that the experiential system is older (in terms of evolutionary status), more adaptive to everyday functioning, and more dominant in our day-to-day endeavors compared with the rational system. According to Epstein, people default to processing information with the experiential system and are only likely to process information in the rational system when incentives for doing so are present. That said, as it pertains to educational contexts, students might not always engage the rational system because this type of information processing is experienced as effortful, takes more time to function, and is more demanding of cognitive resources (Epstein, 2014; Norris & Epstein, 2011). If this is true, educators would be wise to teach to both information processing structures in order to address a broader range of student learning systems. And, if instructors wish to engage the experiential system of information processing, the best way to present information to this system may be through metaphor, imagery, and narrative. Again, this is because the experiential system generalizes, integrates, and directs behavior through prototypical, metaphorical, analogical, and narrative representations of events and information (Epstein, 2003).

Case-based reasoning

One way to help students learn through narrative includes using case studies to teach instructional material. According to Aamodt and Plaza (1994), case-based reasoning (CBR) refers to a person's efforts to solve problems by using knowledge from previously experienced cases and adapting that information to new situations. More specifically, CBR works when a person correctly identifies a new problem, links/matches it to an old problem, and uses the previous solution to either directly address the current issue or to address the issue more flexibly according to existing differences. The major idea with CBR is that people arrive at solutions to new problems by reusing information from similar situations.

As it pertains to the use of narratives in instructional contexts, Jonassen and Hernandez-Serrano (2002) argue that "stories are the most natural and powerful formalism for storing and describing experiential knowledge that is essential to problem solving" in CBR (p. 65). The authors argue this is because humans organize their experiences in the form of stories and that stories require less cognitive effort to process compared with other types of information. Similarly, Paulus, Horvitz, and Shi (2006) noted that stories can be used for CBR insofar as people faced with new problems think back to similar experiences and apply lessons from those to new scenarios.

Although CBR tends to operate by linking one's own experience to new situations, stories from others might be substituted for direct experience in order to serve as examples for possible solutions. Specifically, Jonassen and Hernandez-Serrano (2002) argued that "stories can function as a substitute for direct experience, which novice problem solvers do not possess" (p. 69) and thus, "supporting learning with stories can help students to gain experience vicariously" (p. 69). Moreover, Jonassen and Hernandez-Serrano (2002) claim that "because direct personal experiences are difficult to execute and control, stories are the best available sources of insight while learning to solve problems" (p. 74). As a result, Jonassen and Hernandez-Serrano (2002) suggest that stories can benefit students when they are used as examples of concepts/principles and as case studies that students work on solving. Other researchers would agree with the conclusions drawn above. For example, Paulus et al. (2006) claimed that one way to give students experience with solving problems is to help them learn course lessons vicariously through the use of stories. Similarly, Green and Brock (2000) argued that stories perceived to be concrete (i.e., easy to imagine, relevant) and memorable can transport people so that they experience narratives immersively, as if they were a part of the stories being told. Subsequently, when listeners are transported by stories, individuals' real-world beliefs can be influenced through vicarious experience and the mental simulation of specific events (Green, 2006; Green & Brock, 2000).

Ultimately, stories are helpful in class because they facilitate positive student outcomes. For example, Paulus et al. (2006) showed that students who were exposed to a course lesson presented in a story format were emotionally engaged, experienced the lesson as credible/relevant, thought about how the lesson applied to their lives, and thought about how to apply the lesson in future scenarios. As further evidence regarding the impact of stories on students' classroom experiences, Hernandez-Serrano and Jonassen (2003) studied how students exposed to stories or abstract fact sheets used these resources to solve problems in a new context. Results indicated that students who were given stories in the form of case studies outperformed students who studied from fact sheets when it came to applying this information to novel problem-solving scenarios.

According to Hernandez-Serrano and Jonassen (2003), the power of stories in educational contexts comes from their ability to provide learners with memorable scripts that contain information about how to approach novel problems. Schank's (1999) work on memory supports this conclusion. Specifically, he suggests that humans learn as their experiences become categorized and generalized to produce scripts that inform/remind them about which behaviors tend to produce successful outcomes. Essentially, Schank (1999) claims that memories work by collecting experiences to make predictions about novel situations, and we are able to operate in the world insofar as we can recall prior experiences and use them in an immediate context. As Schank argues, transfer problems in student learning stem from school-based lessons that are context free and therefore unlikely to attach to appropriate behavioral scripts. In other words, "people need a context to help them relate what they have heard to what they already know" (Schank, 1999, p. 90). This is because when new information is presented to us "without a context, we cannot decide the validity of the rule we have heard, nor do we know where to store it in our memories" (p. 90). Ultimately, Schank reasoned that narratives are easier to remember than a simple list of facts because stories have an inherent structure that creates a coherent whole from pieces of scattered information. Stated differently, stories help students learn because they are contextualized and stored as units comprising various pieces of information that would otherwise be difficult to access individually. Ultimately, Schank claimed that stories are important to learning because when confronted with new problems, people attempt to solve these by recalling scripts from applicable stories. And, although repeated experience can lead to appropriate scripts, script building also when we learn from the experiences of others (Schank, 1999).

Narrative components of effective stories

If stories are beneficial to student learning, one question readers might reasonably ask is: are all stories the same when it comes to their instructional effectiveness? Based on our review of the literature, the answer to that question is no. In particular, researchers suggest that three aspects make stories effective in scenarios involving CBR: course orientation, concreteness, and memorability.

Course orientation. According to Jonassen and Hernandez-Serrano (2002), one important aspect of effective instructional stories is their ability to provide solutions to classroom questions. Put simply, to be effective instructional stories need to explain course concepts. The authors note that using stories and cases in education is important to the extent that they help learners think about, explain, understand, and remember course concepts clearly. This can happen when instructors use stories to describe causes, failures, and potential solutions related to various classroom topics. The more stories map onto course information, the more likely students will benefit from these. As Aamodt and Plaza (1994) explained, CBR works when students correctly identify a new problem as a match to an old problem, and then use the previous solution to address the current issue. More specifically, this matching involves identification of similar qualities between two experiences that share surface features such as particular aspects of a story or deeper-level features such as goals and general problem-solving principles. Thus, if stories are not aligned with learning objectives, they should be of little help to student learning (i.e., there is no match to make). In fact, stories that are not related to course concepts might even be considered harmful because superfluous information can lead to lower perceptions of clarity through their impact on instructional coherence (Bolkan, 2017).

Concreteness. The second aspect of effective stories refers to the concreteness of instructional narratives. Concrete stories include narratives that are vivid, easy to imagine, and link to students' own experiences. Stated differently, concrete stories allow students to picture events in their heads. Proponents of dual-coding theory argue that spoken language can differ in its ability to create images in people's minds (Sadoksi & Paivo, 2013). That said, the more people code information both verbally and nonverbally (i.e., as both words and images), the better they should be able to comprehend and remember this information. Because concrete information evokes mental imagery (Sadoski, 2001), it is coded in both a linguistic and a nonverbal mode which allows for more referential connections between the two, provides a context that contributes to meaning, and makes the information easier to understand and more memorable (Sadoksi & Paivo, 2013;

Sadoski & Quast, 1990). Research in instructional communication supports this conclusion insofar as the provision of concrete examples has been shown to make information clear to students (Bolkan, 2017). Thus, stories that are easy to imagine should be more likely to help students make sense out of their lessons.

Pertaining to one's own experiences, Jonassen and Hernandez-Serrano (2002) argue that stories are helpful in educational settings to the extent that they are comparable with prior knowledge and can be mapped onto known events. Other scholars agree and note that stories must be familiar/recognizable in order for them to be useful in future problem-solving episodes (e.g., Paulus et al., 2006; Schank, 1999). In other words, in order for stories to be useful, they must associate with students' prior experience to help them reflect on their own solutions and behaviors. Thus, when stories are recognizable or familiar to students, they should provide a context for imagining class lessons and, in doing so, make course information more comprehensible. In summary, stories that are concrete, easy to imagine, and linked to students' experiences should benefit student learning to the extent that these stories provide clarity for instructional lessons.

Memorability. The final component of effective instructional stories refers to the extent to which students can remember them. It stands to reason that memorable stories are more useful to students than those that are difficult to recall. This conclusion has support from Hernandez-Serrano and Jonassen (2003) who noted that in order for stories to be helpful, they must be recognized and subsequently related to future problems. That said, if students cannot remember a particular narrative, it would be difficult for the story to be of much use for problem-solving (Jonassen & Hernandez-Serrano, 2002). Schank (1999) would agree and asserts that we are able to operate in the world insofar as we can recall prior experiences and use them in an immediate context. Schank claims that our ability to find the correct memory for use when interpreting a new experience is at the heart of what it means to understand.

Based on the information presented above, we predicted that a new measure of instructional narratives would be best modeled by a three-factor solution representing three aspects of effective storytelling (i.e., course orientation, concreteness, and memorability). To help guide our inquiry, we offered the following hypothesis:

H1: A three-factor model of instructional narratives will be the best fit to the data.

Rationale

To assess the construct validity of the new scale, we examined how the new measure associated with important student outcomes including students' ability to understand class lessons and their motivation to attend to these. First, to determine how the new measure associated with students' ability to understand their lessons, we examined how stories associated with clear teaching by focusing on their associations with instructor disfluency and coherence. Disfluency occurs when teachers have a hard time explaining course concepts (Bolkan, 2017). Thus, it was our contention that memorable stories related to class content and explained in concrete terms should be negatively correlated with disfluency. Coherence refers to communication that is off topic or tangential to student learning (Bolkan, 2017). Because stories have the potential to explain or contextualize class topics in a manner that complement the presentation of abstract principles, we predicted that students would perceive memorable and vivid stories that are related to course content as necessary for instruction. We also examined how storytelling might reduce students' cognitive load, operationalized as the level of difficulty associated with learning educational material (Paas, 1992). It was our contention that teachers who tell imaginative, memorable, and course-oriented stories might engage the experiential system, and because processing in this system is considered to be less resource-intensive than in the rational system (Norris & Epstein, 2011), we predicted that stories would be negatively associated with students' experiences of cognitive burden in class. Second, regarding students' motivation to attend to their lessons, we assessed how the new measure related to students' reports of content relevance, attention, interest. Specifically, we predicted that course-oriented, concrete, and memorable stories would pique students' attention and would be perceived as interesting and important too. We used the following hypotheses to guide our inquiry.

> H2: All three dimensions of instructional narratives (i.e., course orientation, concreteness, and memorability) will be associated negatively with disfluency and coherence, and with cognitive load.

> H3: All three dimensions of instructional narratives (i.e., course orientation, concreteness, and memorability) will be associated positively with student perceptions of instructional relevance, attention, and interest.

Another goal of this study was to determine the unique contribution of each aspect of storytelling to the student outcomes listed above. Because we did not have any specific predictions, we used a research question to help guide our analyses.

> RQ: What is the unique contribution of each dimension of instructional narratives to clarity, relevance, attention, interest, and cognitive load?

Method

Participants and procedures

After receiving approval from the institutional review board, participants ($N = 598$; 200 men and 391 women, seven individuals did not provide this information) were recruited from upper- and lower-division communication courses at a university on the East Coast. Participants' ages ranged from 18 to 49 ($M = 20.2$, $SD = 3.0$). One hundred and sixty two individuals reported being in their first year of college, 121 reported being in their second year, 148 reported being in their third year, and 154 reported being in their fourth year (12 students reported "other," one participant did not provide information). Participants who agreed to take part in this study were given a link to an online survey where they provided their demographic information and were directed to think about the professor they had for their last class of the week when responding to the survey items. Along with their responses to items from the story instrument, participants reported on their instructors' perceived clarity and relevance, and their own experiences of attention, emotional and cognitive interest, and cognitive load.

Instrumentation

All multi-item measures were examined for reliability by calculating omega (ω) using point and interval estimations of composite reliability. For estimating reliability, omega is a superior alternative to Cronbach's alpha (α) for several reasons including less restrictive assumptions (e.g., the assumption of tau-equivalence) and better precision of the reliability estimate. In general, communication scholars should get into the habit of reporting ω instead of α for reliability estimation (for a discussion of the reasons, see Dunn, Baguley, & Brunsden, 2014; for details on how to calculate ω, see Bandalos, 2018; Raykov & Marcoulides, 2011). Using maximum likelihood estimation, composite reliability of the subscales was assessed by ω with 95% confidence intervals derived from 10,000 bias-corrected bootstrap samples (Raykov & Marcoulides, 2011). Raykov and Marcoulides (2011) consider reliability above .80 as satisfactory for scale construction.

The measures of disfluency and coherence were taken from Bolkan (2017). Each measure has four items ranging from (1) *strongly disagree* to (7) *strongly agree*. Example items for disfluency include "My teacher has a hard time explaining things in a simple manner" and "My teacher has a hard time coming up with appropriate examples to explain course concepts" ($\omega = .941$, 95% CI: .928, .951; $M = 2.68$, $SD = 1.57$). Example items for coherence include "This teacher goes on unrelated tangents when we are discussing ideas in class" and "In our lectures, we often receive information that is not essential to learning course concepts" ($\omega = .947$, 95% CI: .934, .957; $M = 2.80$, $SD = 1.63$).

Content relevance was measured with a 12-item scale taken from Frymier and Shulman (1995). Responses to these items could range from (0) *never* to (4) *very often* ($\omega = .944$, 95% CI: .934, .952; $M = 2.63$, $SD = .86$). Examples of items from this measure include "My teacher uses examples to make the content relevant to me," and "My teacher provides explanations that make the content relevant to me."

The measure of sustained attention was adapted from Wei, Wang, and Klausner (2012) by reducing the original number of items from five to three. This version of the scale has been used by instructional communication scholars in the past (Bolkan & Griffin, 2018). Response options for this scale range from (1) *not at all true of me* to (7) *very true of me* ($\omega = .892$, 95% CI: .869, .910; $M = 4.78$, $SD = 1.33$). Items in this scale include "I pay full attention to the lectures," "I do not shift my attention to other nontask-oriented activities," and "I sustain my attention to learning throughout the lectures."

Student interest was measured in this study using the scale developed by Mazer (2012). This scale has 16 items with response options ranging from (1) *strongly disagree* to (5) *strongly agree*. Two subscales make up this measure and include emotional (nine items) and cognitive interest (seven items). Examples of items in the emotional interest scale include "The class makes me feel excited," and "The class experience feels very positive" ($\omega = .949$, 95% CI: .941, .956; $M = 3.35$, $SD = .91$). Examples of items in the cognitive interest scale include "I feel like I am learning topics covered in the course," and "I understand the course material" ($\omega = .889$, 95% CI: .868, .907; $M = 3.81$, $SD = .71$).

Cognitive load was measured using one item adapted from Korbach, Brünken, and Park (2018) based on original work from Paas (1992). This item asked participants to report the extent to which they believed the material in class lectures was difficult to learn. Response options ranged from (1) *very easy* to (7) *very difficult* ($M = 3.74$, $SD = 1.59$).

When creating the scale to measure students' assessment of narratives, we generated 45 items for the initial item pool comprising all factors. We chose this number because it represents the recommended number of items (i.e., three to four times more items than we would ideally retain after trimming items with low factor loadings) for scale construction in our study (Bandalos, 2018). Based on the work of several scholars who study CBR

(Aamodt & Plaza, 1994; Hernandez-Serrano & Jonassen, 2003; Jonassen & Hernandez-Serrano, 2002; Paulus et al., 2006; Schank, 1999), we created 15 items for each of the three hypothesized dimensions of storytelling including (1) providing solutions to classroom questions/explaining topics from the course, (2) making stories concrete, and (3) being memorable. Finally, one item was used to determine the frequency with which instructors used stories in their classrooms. In particular, to ensure that students were reporting on instructors who actually told stories, we asked students: "In this class, how often does your professor tell stories while he/she is teaching?" Response included (0) *never tells stories in class*, (1) *tells stories in class at least once a month*, (2) *tells stories in class at least once a week*, (3) *tells stories in class several times a week*, and (4) *tells stories in class every time he/she teaches* ($M = 2.30$, $SD = 1.23$).

Results

Step 1

Step 1 of our data analysis included an exploratory factory analysis (EFA) using Mplus 8.0 (Muthén & Muthén, 2017) with robust maximum likelihood estimation to determine the appropriate number of factors and items for our new scale. Exploratory factor analysis in Mplus allows for the comparison of various models with fit statistics to help guide selection decisions. We conducted our data analysis by randomly selecting approximately 50% of our original sample ($n = 307$) and requesting results for models with solutions ranging from one through four possible factors using GEOMIN rotation to allow for correlations between factors. Bartlett's test of sphericity χ^2 (990) = 12,239.15, $p < .01$ indicated the data were adequate for investigation. Results (see Table 1) indicated the superiority of a four-factor solution that appeared to fit the data relatively well: Steiger–Lind root mean error of approximation (RMSEA) = .060 (90% CI: .056, .064), Bentler comparative fit index (CFI) = .920, standardized root mean square residual (SRMR) = .023.

Although we found support a four-factor solution, only three factors had eigenvalues above 1.0. Furthermore, we examined the rotated loadings and retained only those variables that loaded on a primary factor at .50 or above and that did not also load on a secondary factor at .30 or above. Using this criteria, we found three interpretable factors. Based on eigenvalues and factor interpretability, we concluded that three factors best represented the data (see Table 2). Ten items loaded on the first factor we characterized as *course-oriented* stories. Thirteen items loaded on the second factor we labeled *concrete* stories. Finally, four items loaded on the factor designated *memorable* stories. Using

Table 1. Summary of model fit.

Model	Parameters	Chi-square	AIC	BIC	*df*	*p*
One-factor	135	3,374.05	37,785.57	38,287.37	945	<.01
Two-factors	179	2,362.46	36,275.26	36,940.60	901	<.01
Three-factors	222	1,909.09	35,671.05	36,496.23	858	<.01
Four-factors	264	1,713.04	35,404.65	36,385.94	816	<.01
Models compared						
1 vs 2		644.99			44	<.01
2 vs 3		358.70			43	<.01
3 vs 4		154.07			42	<.01

Note: Chi-square = Satorra–Bentler scaled chi-square. AIC = Akaike Information Criteria, BIC = Bayesian Information Criteria.

Table 2. GEOMIN Rotated Loadings (Four Factors).

Item	Factor 1	2	3	4
1: Provide solutions to classroom questions	.61	.02	.36	.10
2: Are easy to remember	.31	.39	.24	.13
3: Remind me of previous personal experiences	.08	.31	.22	.34
4: Explain topics from the course	.94	−.13	.34	−.02
5: Are interesting	−.03	.70	.34	.08
6: Are easy to relate to	−.07	.82	.29	−.02
7: Demonstrate class concepts	.81	.06	.31	−.06
8: Are vivid	.13	.62	.18	.00
9: Are linked to what I know	.47	.39	.07	.01
10: Show how ideas from class operate in various contexts	.80	.17	.07	−.08
11: Are engaging	.14	.61	.17	.16
12: Are similar to situations I am familiar with	.07	.72	.01	.03
13: Detail how course lessons can be applied in different situations	.64	.20	.02	.07
14: Are captivating	.01	.66	.03	.26
15: Are associated with scenarios I can imagine	.10	.90	−.03	−.16
16: Make a point about what we are learning	.77	.18	−.01	−.06
17: Are attention-grabbing	.02	.72	.05	.17
18: Overlap with my personal observations	.16	.44	.01	.32
19: Provide examples of class principles	.78	.07	.06	.03
20: Are stimulating	−.06	.73	−.08	.25
21: Are easy to understand	.04	1.02	−.10	−.26
22: Clarify ideas from class	.69	.20	−.06	.07
23: Are exciting	−.01	.52	.10	.41
24: I empathize with	−.09	.61	.07	.37
25: Illustrate class lessons	.89	−.01	.04	.05
26: Are thought provoking	.39	.18	.03	.33
27: I can identify with	.03	.75	−.04	.07
28: Exemplify course concepts	.83	.06	.02	.05
29: Are unforgettable	.01	.14	.06	.73
30: Are easy to visualize	.14	.68	−.05	.07
31: Reveal how ideas from class work	.92	.00	−.06	.00
32: Stand out in my memory	−.06	.38	−.03	.60
33: Make sense	.10	.83	−.09	−.03
34: Express how course concepts can be used to solve problems	.74	−.02	−.05	.21
35: Are noteworthy	.32	−.07	−.09	.67
36: Are easy to follow	.13	.67	−.03	.06
37: Make me think about my own experiences as they apply to what we have learned	.30	.25	−.07	.41
38: Are memorable	.03	.19	.08	.70
39: Make me recall similar stories	.04	.32	.12	.54
40: Allow me to use course lessons to see the world differently	.40	.08	.02	.49
41: Are catchy	.06	.27	.09	.61
42: Set me off on chains of thought regarding what I already know	.30	.03	−.05	.56
43: Help me make sense out of the ideas we are being taught	.63	.11	−.09	.24
44: Stick with me	.16	.11	−.03	.69
45: Help me reflect on things I have learned previously	.58	−.08	−.06	.50

Note: Eigenvalues for the four factors are: (1) 29.76, (2) 2.368, (3) 1.47, (4) .91.

these items, we conducted another EFA specifying three factors. Bartlett's test of sphericity χ^2 (351) = 6,018.85, $p < .01$ indicated the data were adequate for investigation. Results (see Table 3) indicated this model fit the data relatively well (RMSEA = .061, 90% CI: .054, .068; CFI = .946, SRMR = .023).

Step 2

In step 2, we conducted a confirmatory factor analysis with robust maximum likelihood estimation using the second half of our randomized data ($n = 291$). To conduct this

Table 3. GEOMIN Rotated Loadings (Three Factors).

	Factor		
Item	1	2	3
Course-oriented			
1: Show how ideas from class operate in various contexts	.73	.27	−.10
2: Detail how course lessons can be applied in different situations	.61	.27	.02
3: Make a point about what we are learning	.74	.21	−.06
4: Provide examples of class principles	.71	.18	.00
5: Clarify ideas from class	.65	.22	.07
6: Illustrate class lessons	.90	−.01	.06
7: Exemplify course concepts	.80	.11	.03
8: Reveal how ideas from class work	.97	−.06	.00
9: Express how course concepts can be used to solve problems	.75	−.04	.19
10: Help me make sense out of the ideas we are being taught	.65	.04	.26
Concrete			
1: Are easy to relate to	−.20	.98	.01
2: Are vivid	−.01	.76	.03
3: Are engaging	.05	.66	.24
4: Are similar to situations I am familiar with	−.01	.83	−.02
5: Are captivating	−.06	.67	.31
6: Are associated with scenarios I can imagine	.03	1.00	−.20
7: Are attention−grabbing	.00	.70	.21
8: Are stimulating	−.06	.65	.29
9: Are easy to understand	.00	1.05	−.28
10: I can identify with	.02	.77	.02
11: Are easy to visualize	.10	.71	.06
12: Make sense	.08	.85	−.07
13: Are easy to follow	.08	.69	.07
Memorable			
1: Are unforgettable	.02	.01	.85
2: Are memorable	.02	.09	.81
3: Are catchy	.02	.21	.71
4: Stick with me	.17	.01	.75

Note: Eigenvalues for the three factors are: (1) 18.28, (2) 1.67, (3) 1.02.

analysis, we specified a model with three factors predicted by the items retained from the EFA (see Table 3). Results from the global fit indices indicated that the model fit the data relatively well, Satorra–Bentler scaled $\chi^2 = 790.83$, $df = 321$, $p < .01$, RMSEA = .071 (90% CI: .065, .077), CFI = .922, SRMR = .035, AIC = 19,154.92, BIC = 19,462.90. In addition, our examination of the normalized residuals indicated that the model fit at a local level relatively well (see Table 4 for factor loadings).

Though the model fit the data well, the measure appeared long with the dimensions of course orientation and concreteness each containing redundant items. Thus, four of the highest-loading, nonredundant, and conceptually consistent items were chosen to represent each of these scales (DeVellis, 2017; Worthington & Whittaker, 2006). A final scale containing three dimensions with four items per dimension was subjected to a confirmatory factor analysis (see Table 5). Results from the global fit indices revealed that the model fit the data relatively well: Satorra–Bentler scaled $\chi^2 = 91.20$, $df = 51$, $p < .01$, RMSEA = .052 (90% CI: .034, .069), CFI = .980, SRMR = .028, AIC = 9,143.05, BIC = 9,286.37. In addition, the normalized residuals indicated that the model fit at a local level relatively well. The final three-dimensional scale is called the Student Assessment of Narrative (SAN).

Because correlations between the latent variables were substantial, we examined how two additional models fit the data. First, we tested a one-factor solution to determine if this model fit the data better than a three-factor solution. Results indicated that the one-factor model was not a good fit to the data: Satorra–Bentler scaled $\chi^2 = 335.67$,

Table 4. Confirmatory Factor Analysis.

	Factor		
Item	1	2	3
Course-oriented			
1: Show how ideas from class operate in various contexts	.85		
2: Detail how course lessons can be applied in different situations	.88		
3: Make a point about what we are learning	.90		
4: Provide examples of class principles	.90		
5: Clarify ideas from class	.91		
6: Illustrate class lessons	.92		
7: Exemplify course concepts	.93		
8: Reveal how ideas from class work	.92		
9: Express how course concepts can be used to solve problems	.89		
10: Help me make sense out of the ideas we are being taught	.87		
Concrete			
1: Are easy to relate to		.84	
2: Are vivid		.81	
3: Are engaging		.90	
4: Are similar to situations I am familiar with		.79	
5: Are captivating		.88	
6: Are associated with scenarios I can imagine		.90	
7: Are attention-grabbing		.90	
8: Are stimulating		.87	
9: Are easy to understand		.87	
10: I can identify with		.85	
11: Are easy to visualize		.89	
12: Make sense		.88	
13: Are easy to follow		.87	
Memorable			
1: Are unforgettable			.81
2: Are memorable			.92
3: Are catchy			.87
4: Stick with me			.92

Note: Factor loadings are standardized.

Table 5. Student Assessment of Narrative: Confirmatory Factor Analysis.

				Bifactor loadings	
	Factor			Subfactor	General
Item	1	2	3		
Course-oriented					
1: Clarify ideas from class	.91			.31	.85
2: Illustrate class lessons	.93			.38	.85
3: Exemplify course concepts	.94			.39	.86
4: Reveal how ideas from class work	.90			.34	.84
Concrete					
1: Are easy to relate to		.85		.43	.82
2: Are similar to situations I am familiar with		.81		.39	.77
3: Are associated with scenarios I can imagine		.90		.11	.89
4: Are easy to visualize		.89		−.04	.90
Memorable					
1: Are unforgettable			.82	.47	.67
2: Are memorable			.92	.51	.79
3: Are catchy			.87	.34	.80
4: Stick with me			.93	.43	.82

Note: Factor loadings are standardized. Factor loadings represent loadings for the correlated three-factor scale. Bifactor loadings represent loadings on specific group subfactors and a general unidimensional factor. Items start with "My professor tells stories that…"

$df = 54$, $p < .01$, RMSEA = .134 (90% CI: .121, .148), CFI = .862, SRMR = .056, AIC = 9,594.07, BIC = 9,726.06.

Next, we tested a restricted bifactor model where each observed variable loaded onto its group subfactor (i.e., course orientation, concrete, memorable), and also onto on a single, orthogonal general factor (Reis, Moore, & Haviland, 2010). As Reis et al. (2010) noted, "the bifactor model specifies that there is a single (general) trait explaining some proportion of common item variance for all items, but that there also are group traits explaining additional common variance for item subsets" (p. 547). In other words, a bifactor model assumes that subsets of items tap into specific dimensions of a construct as well as a larger more general factor. In terms of the current study, a bifactor model assumes that the items used in the SAN reflect both a common general variable of effective storytelling, and also specific aspects of effective storytelling (i.e., making stories course-oriented, concrete, and memorable). Results from our analysis indicated that a bifactor model fit the data well: Satorra–Bentler scaled $\chi^2 = 47.40$, $df = 42$, $p = .26$, RMSEA = .021 (90% CI: .000, .047), CFI = .997, SRMR = .015, AIC = 9,085.89, BIC = 9,261.88, and a Satorra–Bentler scaled χ^2 difference test indicated that the bifactor model fit the data better than the original three-factor model: Satorra–Bentler scaled $\chi^2 = 39.68$, $df = 9$, $p < .01$. Moreover, inspecting the normalized residuals revealed that the model fit at a local level relatively well.

In addition, we calculated the explained common variance (ECV), the percentage of uncontaminated correlations (PUC), and the omega hierarchichal (ω_H) in our data to determine if the multidimensional model could be reasonably interpreted as reflecting a single underlying dimension (see Reis, 2012; Reise, Scheines, Widaman, & Haviland, 2013). These statistics were used because, taken together, the ECV and the PUC highlight "the degree of unidimensionality, or relative strength, of general to group factors" (Reise et al., 2013, p. 11). Moreover, when ω_H is high, "composite scores predominantly reflect a single common source even when the data are multidimensional" (Reis, 2012, p. 690). In this study, the ECV was .83, the PUC was .82, and the ω_H was .94. These results indicate that, despite its multidimensional nature, items in the SAN might appropriately represent a common general factor related to effective instructional storytelling.

Finally, we calculated omega reliability coefficients for the subscales to ascertain model reliability estimates for each. These coefficients were .94 for the course-oriented subscale, .95 for the concrete subscale, and .94 for the memorable subscale However, because of the bifactor nature of the scale, we also calculated model reliability estimates for the subscales with the effects of the general factor removed. These coefficients were .14 for the course-oriented subscale, .06 for the concrete subscale, and .23 for the memorable subscale. According to Reis (2012), these latter figures demonstrate that "if both total scores and subscales were to be formed, the interpretation of the subscales as precise indicators of unique constructs is extremely limited" (p. 691). Based on the results presented above, we concluded that Hypothesis 1 was partially supported.

Validity tests

Correlation analyses

To test the construct validity of the scale, both sets of participants (from steps one and two) were combined to examine how the three aspects of the SAN associated with important

Table 6. Correlations.

Variable	1	2	3	4	5	6	7	8	9	10
1. General measure										
2. Course-oriented										
3. Concrete		.80								
4. Memorable		.72	.78							
5. Disfluency	−.37	−.37	−.39	−.26						
6. Coherence	−.24	−.29	−.25	−.14	.76					
7. Relevance	.79	.70	.73	.74	−.32	−.25				
8. Attention	.43	.36	.39	.43	−.11	−.10*	.41			
9. Emotional interest	.66	.56	.60	.66	−.24	−.17	.70	.55		
10. Cognitive interest	.61	.56	.61	.51	−.34	−.28	.66	.43	.74	
11. Cognitive load	−.37	−.33	−.36	−.32	.10*	.09*	−.41	−.14	−.33	−.41

Note: General measure refers to a unidimensional measure of the SAN ($M = 5.09$, $SD = 1.31$). Using the total sample, reliability for the unidimensional scale is $\omega = .960$, 95% CI: .953, .966. Because the one-factor model is orthogonal to the subfactors, correlation coefficients were not calculated in the table. All correlations are significant at $p < .01$ (two-tailed), except $^*p < .05$. Using the total sample, reliability coefficients for the subcomponents of the SAN are: Course-oriented: $\omega = .953$, 95% CI: .942, .961; $M = 5.34$, $SD = 1.43$, Concrete: $\omega = .910$, 95% CI: .893, .924; $M = 5.18$, $SD = 1.33$, and Memorable: $\omega = .933$, 95% CI: .919, .943; $M = 4.74$, $SD = 1.51$.

educational outcomes ($N = 598$). As predicted in Hypothesis 2, all three dimensions of instructional narratives and the general measure were negatively associated with disfluency, coherence, and cognitive load. Similarly, as predicted in Hypothesis 3, all three dimensions of instructional narratives and the general measure were positively associated with student perceptions of instructional relevance, attention, and interest (see Table 6 for details).

Regression analyses

To test the research question, we examined the unique contribution of each dimension of the SAN to the outcome variables using ordinary least squares regression analyses and 10,000 bias-corrected bootstrapped samples (see Table 7). Pertaining to clarity, results indicated that course-oriented ($B = -.24$, 95% CI: −.399, −.082) and concrete stories ($B = -.40$, 95% CI: −.569, −.218) were inversely associated with disfluency. Holding the other variables constant, memorable stories ($B = .16$, 95% CI: .034, .295) were positively associated with perceptions of instructor disfluency. Similarly, course-oriented ($B = -.35$, 95% CI: −.518, −.184) and concrete stories ($B = -.21$, 95% CI: −.395, −.007) were negatively associated with perceptions of instructional coherence, whereas memorable ($B = .23$, 95% CI: .082, .370) stories were positively associated with this outcome. Perceptions of course relevance were positively predicted by all three aspects of the SAN (course-oriented: $B = .13$, 95% CI: .065, .198; concrete: $B = .18$, 95% CI: .103, .250; memorable: $B = .21$, 95% CI: .160, .256). However, student attention was predicted by memorability alone ($B = .27$, 95% CI: .161, .387). Emotional interest was predicted by concrete ($B = .11$, 95% CI: .032, .199) and memorable stories ($B = .29$, 95% CI: .220, .347) whereas cognitive interest was predicted by stories that were course-oriented ($B = .09$, 95% CI: .029, .157) and concrete ($B = .23$, 95% CI: .156, .302). Finally, cognitive load ($B = -.25$, 95% CI: −.429, −.086) was inversely related to concrete stories only.

Discussion

When new information is presented to us “without a context, we cannot decide the validity of the rule we have heard, nor do we know where to store it in our memories” (Schank,

Table 7. Regression Analyses.

Variable	*B*	*SE*	*β*	*t*	*F*	*df*	R^2
Disfluency					39.96**	3, 594	.17
Constant**	5.23	.25		21.38			
Course-oriented**	−.24	.07	−.21	−3.32			
Concrete**	−.40	.08	−.34	−4.75			
Memorable*	.16	.06	.15	2.50			
Coherence					22.07**	3, 594	.10
Constant**	4.65	.26		17.66			
Course-oriented**	−.35	.08	−.31	−4.58			
Concrete*	−.21	.09	−.17	−2.29			
Memorable**	.23	.07	.21	3.29			
Relevance					333.47**	3, 594	.63
Constant	.02	.09		.25			
Course-oriented**	.13	.03	.22	5.11			
Concrete**	.18	.03	.27	5.81			
Memorable**	.21	.02	.37	8.92			
Attention					47.57**	3, 594	.19
Constant**	2.67	.20		13.07			
Course−oriented	.05	.06	.05	.80			
Concrete	.11	.07	.11	1.59			
Memorable**	.27	.05	.31	5.08			
Emotional interest					170.34**	3, 594	.46
Constant**	1.13	.11		9.92			
Course-oriented	.05	.03	.08	1.62			
Concrete**	.11	.04	.17	2.95			
Memorable**	.29	.03	.48	9.60			
Cognitive interest					124.52**	3, 594	.39
Constant**	2.03	.10		21.24			
Course−oriented**	.09	.03	.18	3.31			
Concrete**	.23	.03	.43	7.10			
Memorable	.02	.03	.04	.84			
Cognitive load					31.11**	3, 594	.14
Constant**	6.08	.25		24.14			
Course-oriented	−.12	.07	−.11	−1.69			
Concrete**	−.25	.09	−.21	−2.97			
Memorable	−.08	.07	−.07	−1.15			

Note: $^*p < .05$, $^{**}p < .01$.

1999, p. 90). Consequently, pertaining to learning environments, the presentation of abstract information is not likely to benefit students as much when it is presented alone compared with being presented in a setting that allows learners to see how various principles actually work. As supporters of dual-processing theories would argue, this is largely because humans have two information processing systems that operate when people are exposed to various stimuli (Epstein, 2003, 2014; Evans & Stanovich, 2013; Norris & Epstein, 2011; Stanovich, 2004). Thus, when learning complex or abstract information, the provision of stories may benefit students to the extent that these allow learners to engage the full range of their processing systems—including both the rational and experiential systems. That said, stories present information to the experiential system in a language it understands best (i.e., through metaphor and imagery) and are therefore essential to CBR (Jonassen & Hernandez-Serrano, 2002). In this study, we argued that the best stories for learning include narratives that communicate memorable messages, are easy to imagine, and that are related to classroom material. To this point, our goal was to develop a measure to assess the extent to which stories contain these properties in order to determine how the dimensions associated with instructional narratives impact various student outcomes.

In partial support of Hypothesis 1, results from our study demonstrated that a bifactor model was the best interpretation of the data. In a bifactor model, data are interpreted such that "the general factor represents the broad central construct an instrument intends to measure, whereas group factors represent more conceptually specific subdomain constructs" (Rodriguez, Reis, & Haviland, 2016, p. 137; see also Reis, 2012). Considering this, our results indicated that students' experiences of classroom narratives might be appropriately modeled as they relate to a general factor of effective instructional narratives. Therefore, researchers may find it acceptable to measure instructional storytelling using the SAN as a unidimensional construct. Having said the above, if a unidimensional measure is not included in their data analysis, researchers might find it useful to examine the independent impact of the subdimensions of the SAN (i.e., course orientation, concreteness, and memorability) on students' classroom experiences as well. In fact, as we detail below, results from our study demonstrate the utility of doing just that.

In this study, we examined how the three dimensions of instructional storytelling were associated with various student outcomes. Though each of the dimensions was associated with classroom outcomes in the predicted directions in our correlation analyses, some of the more interesting results were found in the regression analyses. For example, pertaining to clarity, we found that each of the dimensions of our new measure was associated with student perceptions of instructor disfluency. Recall that disfluency occurs when instructors have a hard time explaining things in a simple manner (Bolkan, 2017). That said, stories that were concrete (i.e., stories that were easy to relate to and imagine) and that were associated with course concepts reduced students' perceptions of this outcome. In other words, when teachers told vivid stories that were linked to the learning material, students perceived their instructors as being adept at explaining course concepts. Memorability, on the other hand, positively predicted disfluency. Though this result may seem odd, it makes sense when considering that the impact of this dimension of storytelling was calculated after holding the other two dimensions constant. It seems to be the case that memorable stories that are not particularly concrete nor course-oriented have the potential to be reflect poorly on teachers' ability to explain class concepts in a simple manner.

We found similar results when we examined coherence as the outcome variable; course-oriented and concrete stories were inversely related to perceptions of teacher coherence, and memorable stories were positively related to this outcome. In this study, we coded coherence such that higher scores indicated the provision of unnecessary and/or irrelevant information. Keeping this in mind, our results demonstrated that course-oriented and concrete stories led to higher perceptions of teachers being on-task whereas memorable stories led to lower perceptions of this outcome. Ultimately, these results indicate that certain stories might be considered by students to be irrelevant, and when these are particularly memorable, students may perceive their teachers as providing information that is not essential to learning course concepts.

In addition to the relationships between storytelling and clarity, storytelling was also related to perceptions of content relevance and students' attention. In particular, perceptions of relevance were predicted by all three dimensions of the SAN indicating that students believed instructional stories satisfied personal goals (e.g., Frymier & Houser, 1998) when they exemplified course concepts, were associated with scenarios students could imagine, and were unforgettable. These associations make sense considering that relevant lessons are those that students find interesting and valuable (Frymier & Shulman, 1995). According to Keller (1987), relevant instruction occurs when teachers relate information to students' experiences and show how other people have used the information to meet their own goals. That said, both of these behaviors can occur through storytelling. In the current study, we argued that stories that include these behaviors are beneficial to students insofar as they link course material to students' base of knowledge (i.e., are concrete) and explain content (i.e., are course-oriented). Other researchers support the connection between telling appropriate stories and perceived relevance considering relevance can be enhanced to the extent that teachers show students how to apply theory in a practical manner and link content to local and current events (Kember, Ho, & Hong, 2008; Muddiman & Frymier, 2009). Pertaining to attention, only memorability was associated with this outcome. Thus, although course orientation and concreteness might work to make class lessons clear and relevant, these dimensions may not be strong predictors of student focus compared with the components of stories that make them stand out in students' minds.

Student interest was divided into two dimensions including emotional and cognitive interest. Generally, emotional interest refers to students being excited about class whereas cognitive interest refers to students' feelings of mastery in class (Mazer, 2012). Considering these differences, it makes sense that the two types of student interest would be predicted by different dimensions of the SAN. For example, students' emotional interest was predicted by memorable and concrete stories. These stories are catchy and easy to imagine and, at face value, seem like they would be fun to listen to. Because this is the case, it makes sense that they would relate to affective experiences in class. On the other hand, cognitive interest was predicted by course-oriented and concrete stories. These results reveal that students feel like they are learning course concepts when teachers use stories to illustrate class concepts and provide narratives that are easy to relate to. In summary, these results seem to indicate that emotional interest is piqued by exciting stories whereas cognitive interest is stimulated when students are exposed to informational narratives.

Last, cognitive load was predicted by concreteness only. In particular, students exposed to concrete stories believed their lessons took less effort to learn. The finding that stories can reduce cognitive load seems plausible considering that these are processed by the experiential system as opposed to the rational system which is more demanding of cognitive resources (Norris & Epstein, 2011). Thus, teaching with stories that appeal to the experiential system is likely to lead to lower perceptions of effortful learning. Similar to what we found in the current study, researchers who study the impact of imagery on learning support the conclusion that concrete stories, in particular, are most likely to influence this outcome. For example, Sadoksi and Paivo (2013) noted that, compared with concrete language which can be visualized, abstract language is less likely to contain referential connections between personal experiences. Because this is the case, concrete language (i.e., "royal wedding") is more likely to be comprehensible compared with less concrete language (i.e., "official union;" see Sadoksi & Paivo, 2013). Similar conclusions stem from Mayer's (2009) multimedia principle which states that instructional material is better comprehended by students who are taught with words and pictures compared with students who are taught with words alone. In the case of storytelling, the pictures may not be presented in physical form. Instead, these pictures are more likely developed through concrete language that permits visualization in the mind's eye.

Implications for teaching and learning

Results from our analyses demonstrate the telling stories in class is not a guaranteed way to impact student learning in a positive direction. Instead, instructors would be wise to consider what types of stories they tell and to think about how they create these to link to instructional material in a way that students can remember and identify with. First, we might advise instructors to limit their stories to themes related to their educational objectives. This is because course-oriented stories are linked to higher perceptions of clarity and cognitive interest. Stories that are not linked to educational endeavors run the risk of providing superfluous information which may make it difficult for students to identify core instructional content. Moreover, straying from the subject matter is considered by students to represent a teacher misbehavior (Goodboy & Myers, 2015), and stories could lead to negative classroom consequences if instructors are off topic or do not focus on course material.

Pertaining to being concrete, perhaps the best way to move forward with instructional storytelling is to include language that promotes mental imagery. According to Sadoski (2001) this includes language with specific referents (e.g., "volcanic eruption") as opposed to more abstract representations (e.g., "geological event"). These illustrations should help students picture what is happening in a story and help them visualize and imagine the story's events. Moreover, according to Sadoksi and Paivo (2013), specific referents typically stem from listeners' own experiences. Thus, telling stories with which an audience can relate may prove to be useful in learning situations. This might occur when teachers use pop culture or current events in their narratives (Muddiman & Frymier, 2009).

Finally, as long as stories are course-oriented and concrete, instructors might also consider trying to make their narratives memorable. As we mentioned earlier, this is because experience is only useful to future behavior when it can be recalled (e.g., Schank, 1999). One way to make stories more memorable is to accompany them with an index (or various indices) that help remind students when to use the stories when they approach new problem-solving situations. According to Schank, providing categorization principles can help in this endeavor. As it pertains to teaching, instructors might tell students a story and then help them remember it by emphasizing its relation to a high-order principle. This way, when a new problem arises that refers to the principle, students might be able to recall that they have a story which illustrates how to solve the current problem. Another way to make stories more memorable is to make them more interesting (Sadoski, 2001). To this point, Hidi and Baird (1988) surveyed the literature and concluded that stories can be made more interesting if they lead to character identification, violate expectations, document intense action, generate perceptions of novelty, surprise, or uncertainty, or include topics of absolute interest such as life themes including death, danger, and power. Of course, as Hidi and Baird (1988) rightfully point out, instructors should make sure that levels of interestingness do not interfere with students' learning processes. This is important considering that, for example, recent research on humor has shown that funny examples can lead to detriments in student learning compared with standard illustrations (Bolkan, Griffin, & Goodboy, 2018).

Limitations and future directions

One limitation of the current study includes the preliminary nature of our data analyses. Thus, researchers should continue to test the SAN to determine how it performs in new contexts. For example, researchers might examine how different dimensions of instructional narratives influence student outcomes not studied in the current project. These might include students' motivation, affective experiences, and learning. Moreover, future researchers should examine how the use of stories might influence student learning through its impact on students' cognitive load. In this study we used one item to measure the construct based on students' perceptions of how hard it was to learn the material, but researchers can assess cognitive load through a variety of alternative measures (see Brünken, Seufert, & Paas, 2010).

In addition, future researchers might consider examining how the various components of effective storytelling work together to produce outcomes associated with student success. In the current project, we only looked at the unique contributions of each dimension to our outcomes. However, it could be the case that the various dimensions of storytelling interact to produce outcomes that are more dynamic than our simple associations revealed. Moreover, certain aspects of effective storytelling highlighted in this manuscript may also work sequentially through indirect effects. For example, future researchers could examine if the impact of concrete stories on learning occurs indirectly through increased memorability. Additionally, storytelling can function as a relational process and has the ability to promote master narratives that might be considered more or less appropriate to various individuals (Kellas, 2008). Thus, researchers may want to examine how personal factors including sex, age, sexual orientation, and ethnicity directly influence or moderate students' perceptions of effective instructional narratives.

Finally, a third limitation of the current study refers to the need for further validity tests. The current measure is high inference and gets at the important features that stories should offer, but low inference manipulations of these storytelling features are needed to demonstrate that the components of instructor narratives have consequences in real classrooms. Moving into the future, researchers should consider how differences in actual instructional storytelling are associated with various classroom outcomes including student motivation and learning.

Conclusion

In summary, results from this study show that a unidimensional interpretation of the new measure, the SAN, can be used to assess the general effectiveness of instructional storytelling. In addition, we demonstrated that the associations between the individual dimensions of the SAN and instructor clarity and relevance, and students' experiences of attention, interest, and cognitive load were logical and that each of the dimensions had unique associations with these educational outcomes. Taken together, our results indicate that in order to teach clearly, explaining course concepts through stories in a manner that students can easily imagine might prove to be particularly beneficial. Moreover, to capture students' attention and emotional interest, stories must be concrete and memorable. Ultimately, as results from this study demonstrate, effective storytelling is a teaching behavior that instructors might consider using to positively impact students' learning experiences.

Note

1. In this study, we used the terms stories and narrative synonymously. In her review of the literature, Kellas (2008) acknowledged that, although differences exist (i.e., narrative is typically

considered to reflect a broader range of communication behaviors compared with narrower stories), scholars often use these terms interchangeably.

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