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## Research Article

# FLIPBOOKS FOR CREATIVE LEARNING OF BIOLOGY

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### ABSTRACT

Variety of learning experiences sustains interest in learning. In this circumstance, it is believed that use of flipbooks may be one such variety to break the monotony of traditional 'chalk and talk' method of teaching and to ensure commitment in learning. In this connection, present study aims to (a) develop flipbook in biological concepts of VIII - X class (CBSE), (b) find out the effectiveness of these books in concept learning and (c) find out the opinion of pre-service teacher-trainees and teacher educators about the book. Biological concepts like nutrition in *Amoeba*, budding and locomotion in *Hydra* were depicted using clay models. Gradual changes in these processes were photographed, labeled and described; then printed, arranged serially and bounded as flipbook. Using flipbooks VIII<sup>th</sup> class experimental group students learned the concepts of frog metamorphosis and nutrition in *Amoeba* and at the end a test was conducted. In addition, these books were also given to teacher educators (N=13), M.Ed (N=20) and B.Sc. B.Ed (N=89) teacher trainees and VIII<sup>th</sup> class students (N=32) in order to get their opinion about the book. The results showed that average marks in both the concepts and in total were significantly higher in experimental group (8.65, 3.12 and 11.78 respectively) than in control group (4.25, 1.72 and 5.98 respectively). This displayed their better understanding of the concept which in turn indicated that flipbook can be an effective learning tool and can stimulate creativity. Further, the positive opinion of most of the volunteers reflected that flipbooks can be used as an instructional material and can facilitate active and self-learning. Additionally, it can raise students' curiosity and sustain interest in learning; hence, it is strongly recommended for the school teachers and students for effective and creative learning.

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### INTRODUCTION

It is well known that variety of learning experiences sustains interest in learning. In this circumstance, it is believed that use of flipbooks may be one such variety to break the monotony of traditional 'chalk and talk' method of teaching and to ensure devotion in learning. In support to this view, Brown *et al.* (2015) stated that creative book design connects learning in visual arts and language arts. Similarly, Hinshaw and Craig (2012) said that uses of sticky-note flipbooks are engaging approaches to teach young students. Wilson and Linda (1998) conducted an action research project where students created life cycle flipbooks to make connection across the disciplines of science, music and art; and in Virginia students created motion pictures with flipbooks and got hands-on experience (Grambo and Gregory, 1998).

Further, studies justified the use of flip books as they can be used with any subject, and are fun and engaging; they are the alternative

way of assessment, students can retain information and develop creativity (<https> 1). Similarly, studies also advocated for flipbooks that they create interest in learning, interactive and require minimal cutting and gluing (<https> 2), and they can be used as a medium of instruction (Monika *et al.* 2016).

Educationists have developed flipbooks to teach cellular biology (Roberts *et al.*, 2017), environmental pollution (Monika *et al.*, 2016) and geometry (Andini *et al.*, 2018) and found that flipbook is an effective tool to use in high school. Further, Asri and Fitriani (2017) found that flash-flipbook can give effect to increase the spirit of nationalism in elementary school students. Moreover in the recent years, digital flipbooks are also being produced with infusion of audio and video which can be easily portable and downloadable even in mobile phones (Fahmi *et al.*, 2019; Asri and Fitriani, 2017; <https> 3) and also saves printing cost (Andini *et al.*, 2018). On the other hand, Monika *et al.* (2016) prepared a desk calendar type printed flipbook on environmental pollution.

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Incidentally, present study aims to (a) develop flipbook in biological concepts of VIII - X class (CBSE), (b) find out the effectiveness of these books in concept learning and (c) find out the opinion of pre-service teacher trainees, teacher educators and school students about the book.

## MATERIALS AND METHODS

### Construction of flipbook

Using colored clay, small plastic rings, wires, etc., the model of *Amoeba* and *Hydra* were prepared. These models were placed on white tile (one at a time) with enough light. A smart phone was fixed with blue toothed selfie-stick and burette stand; and the phone-camera was focused on the model from top angle. Biological concepts like nutrition in *Amoeba*, locomotion and budding in *Hydra* were depicted/ played with those models on the tile. Gradual changes/ movements in the process were photographed (about 150 nos) and the photos were transferred to computer. They were edited for size, brightness and labeled wherever required.

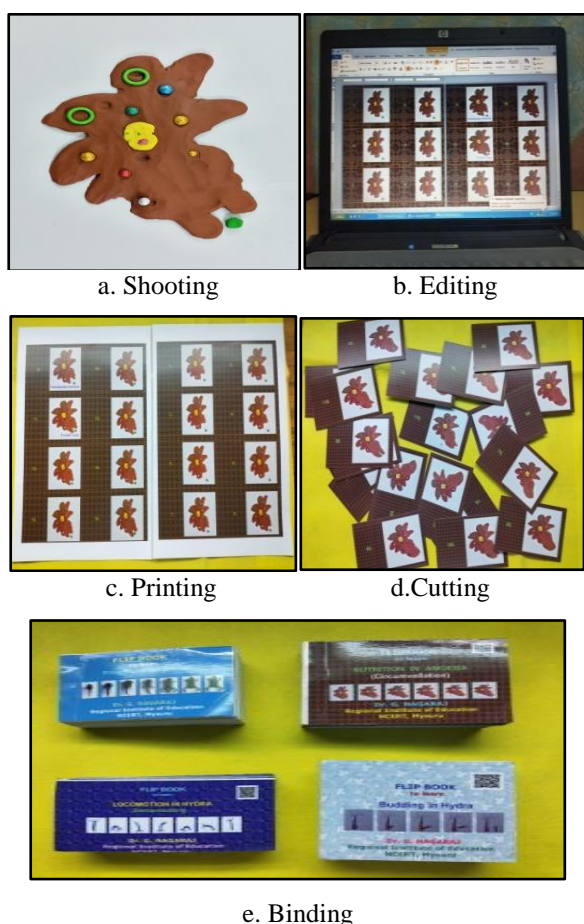


Fig. 1 Various steps/stages in preparation of flipbooks

A table containing 4 columns and 70 to 80 rows (depending upon the number of photos) was made in A4 size word document. First and third columns are narrow for serial numbers (Pic. 1) and in second and fourth columns photos were pasted (about 130; 8 or 10 per page). Between two adjacent rows of photos two narrow rows were left blank as border/ margin for the photos for elegant look of the photo frame. After photos title page, contents, objective of the book, description of concept, parts of the animal, instruction to use, evaluation of learning, information about how the book was prepared, how you can prepare and QR code slot were also made. Final word document was converted in to PDF format and uploaded online for students and teachers to take a printout

(color / black and white) and make flipbook for learning. The web link was converted in to QR code and it was placed on the QR code slot in the word document. This document was digitally printed in color and cut into individual photos with respective serial numbers (Pic. 1). They have been arranged serially and bounded. In another case, an online video (free to use) on metamorphosis in frog was down loaded and converted in to photos with time lapse interval using computer. These photos showing gradual changes in frog metamorphosis were arranged serially in word document and made as flipbook as mentioned previously. In addition to the colored flipbook on metamorphosis in frog, PDF document was also printed in black and white which has only the outline of the picture.

### Pilot study

During summer holidays VI<sup>th</sup> to VIII<sup>th</sup> class children (N=10; boys 4, girls 6) of our institute staffs who are available in the institute campus were recruited for pilot study. Firstly, I asked a question that what is frog metamorphosis? No one answered. Then they were given few copies of flipbook on frog metamorphosis and made them to learn. They gone through the instruction and flipped the book and are delighted to see the changes in the picture i.e. growing of tadpole into adult frog through serious of stages. Then they read about the definition of metamorphosis and are able to answer the questions. They were also given black and white printed template and asked to color the pictures with appropriate color. They colored it, had cut, arranged, stapled and made as a flipbook proudly within 90 mins.

### Experimental and control study

With prior permission from head master of Demonstration school, RIE, Mysuru, VIII-A and VIII-B classes were selected randomly as experimental and control groups respectively. In the experimental group also I asked what is frog metamorphosis? No one could define it correctly. Then experimental group students (N=32) were given flipbook on frog metamorphosis (1 book for 3 students) and asked them to learn the concept on their own by following instructions given in the book. They flipped the book and observed the changes happening in the size, shape, color, etc. of the tadpole/frog (Pic. 2.). Similarly, second flipbook on nutrition in *Amoeba* was given to them to learn. Immediately after completion of both the books a written test was conducted for 15 marks (frog metamorphosis-10 marks and nutrition in *Amoeba*-5 marks). In addition, opinion about flipbook was also collected from them.



Fig 2 Experimental students actively learn by flipping and colouring the flipbook.

Above same question was asked in control group and here also no answer. Then, using “chalk and talk” method both the above concepts were taught in control group and test was conducted immediately. Test papers were evaluated, marks were entered in excel software and average marks for i. frog metamorphosis ii. nutrition in Amoeba and iii. total marks were calculated for both the groups. Significance of differences if any was tested using t-test and the results were tabulated and discussed.

**Opinion collection**

Opinion about the format, content, language practicality and effectiveness of the flipbook (table 2) was collected from I<sup>st</sup> to IV<sup>th</sup> year B.Sc. B.Ed teacher trainees (N=89), teacher educators (N=10) and VIII<sup>th</sup> class students (N=32) of Regional Institute of Education, Mysuru and II<sup>nd</sup> yr M.Ed. students (N=20) from Nagaland University (who came on educational tour). Similarly, by applying pre and post test Andini *et al.* (2018) tested the validity, practicality and effectiveness; and Monika *et al.* (2016) tested the format, content and language of flipbook.

**RESULTS AND DISCUSSION**

It is evident from the table.1 that the average marks in both the concepts and in total was significantly (at 0.01 level) higher in experimental group (8.65, 3.12 and 11.78 respectively) than in control group (4.25, 1.72 and 5.98 respectively). In support, Andini *et al.* (2018) found a significant increase in average score in post-test than pre-test and improvement of drawing skills and Zahro (2017) found that students’ learning achievement was increased after use of flipbook.

**Table 1** Comparison of average marks between experimental and control groups

Group	N	Average marks in Frog Metamorphosis	Average marks in Nutrition in Amoeba	Average total marks
Experimental	32	8.65*	3.12*	11.78*
Control	27	4.25	1.72	5.98
t-value		4.36	6.04	5.00

Note: N = Numbers of VIII<sup>th</sup> class students, \* = t-value was significant at 0.01 level.

It is also observed from the test papers that experimental students wrote and drawn colorfully the sequential stages of frog metamorphosis and nutrition in amoeba and defined metamorphosis correctly whereas, control students failed to do so. The experimental students observed the changes in the book carefully and were able to understand and remember the concepts better than controls. Further, they prepared their own flipbook (15-20 pages) with creative ideas on various topic. However, many of the experimental students also could not define ‘circumvallation’ correctly.

Further, experimental students showed lot of inters and curiosity (Pic. 2) to learn with flipbook. In support, studies also found that flipbook as learning media can raise students’ geometry learning interest (Arsyad, 2011) and are able to develop basic skills of geometry (Purwanto, 2004a, 2004b).

**Table 2** Opinion of teacher trainees and educators and VIII<sup>th</sup> class students about flipbook

Statement	Students-UG/PG/School	I strongly agree		I agree		Uncertain		I disagree		I strongly disagree	
		%	n	%	n	%	n	%	n	%	n
1. It can be used as an instructional tool	I yr	48	15	42	13	10	3				
	II yr	58	11	37	7	5	1				
	III yr	59	10	41	7						
	IV yr	36	8	59	13	5	1				
	M.Ed	80	16	20	4						
	TE	40	4	60	6						
	VIII	31	10	63	20	6	2				
	<b>Average %</b>		<b>51 + 46 = 97</b>			<b>3</b>					
2. It can nurture creativity among students	I yr	68	21	32	10						
	II yr	63	12	37	7						
	III yr	77	13	23	4						
	IV yr	73	16	23	5			4	1		
	M.Ed	80	16	20	4						
	TE	30	3	50	5	20	2				
	VIII	50	16	47	15	3	1				
	<b>Average %</b>		<b>63 + 33 = 96</b>			<b>3</b>		<b>1</b>			
3. It can facilitate active learning	I yr	58	18	39	12	3	1				
	II yr	37	7	58	11	5	1				
	III yr	59	10	41	7						
	IV yr	50	11	45	10	5	1				
	M.Ed	65	13	35	7						
	TE	30	3	60	6	10	1				
	VIII	41	13	53	17	6	2				
	<b>Average %</b>		<b>49 + 47 = 96</b>			<b>4</b>					
4. It can sustain interest in learning	I yr	61	19	39	12						
	II yr	63	12	32	6	5	1				
	III yr	77	13	23	4						
	IV yr	59	13	32	7	9	2				
	M.Ed	55	11	45	9						
	TE	70	7	20	2	10	1				
	VIII	50	16	44	14	6	2				
	<b>Average %</b>		<b>62 + 34 = 96</b>			<b>4</b>					






5. It can improve observation skill	I yr	52	16	35	11	13	4		
	II yr	68	13	21	4	11	2		
	III yr	35	6	53	9	12	2		
	IV yr	32	7	64	14	4	1		
	M.Ed	50	10	45	9	5	1		
	TE	50	5	40	4	10	1		
	VIII	34	11	56	18	10	3		
	<b>Average %</b>			<b>46 + 45 = 91</b>		<b>9</b>			
6. It can help for individualised instruction	I yr	36	11	45	14	13	4	6	2
	II yr	42	8	47	9	11	2		
	III yr	23	4	41	7	36	6		
	IV yr	23	5	59	13	14	3	4	1
	M.Ed	25	5	60	12	15	3		
	TE	10	1	80	8	10	1		
	VIII	37	12	44	14	19	6		
	<b>Average %</b>			<b>28 + 54 = 82</b>		<b>17</b>		<b>1</b>	
7. It can be a self-learning material	I yr	55	17	36	11	9	3		
	II yr	42	8	58	11				
	III yr	41	7	50	11	18	4		
	IV yr	32	7	50	11	18	4		
	M.Ed	45	9	50	10	5	1		
	TE	40	4	30	3	20	2		
	VIII	31	10	47	15	19	6	3	1
	<b>Average %</b>			<b>41 + 46 = 87</b>		<b>12</b>		<b>1</b>	
8. It can raise students' curiosity	I yr	65	21	29	9	3	1		
	II yr	53	10	37	7	10	2		
	III yr	65	11	35	6				
	IV yr	36	8	56	12	4	1	4	1
	M.Ed	80	16	20	4				
	TE	50	5	30	3	20	2		
	VIII	44	14	41	13	12	4	3	1
	<b>Average %</b>			<b>56 + 35 = 91</b>		<b>8</b>		<b>1</b>	
9. Concept is completely presented	I yr	36	11	45	14	16	5	4	1
	II yr	53	10	42	8	5	1		
	III yr	47	8	23	4	30	5		
	IV yr	32	7	60	13	4	1	4	1
	M.Ed	25	5	45	9	25	5	5	1
	TE	50	5	30	3	20	2		
	VIII	31	10	50	16	16	5	3	1
	<b>Average %</b>			<b>39 + 42 = 81</b>		<b>17</b>		<b>2</b>	
10. Color in text and picture is suitable	I yr	45	14	55	17				
	II yr	58	11	42	8				
	III yr	53	9	47	8				
	IV yr	59	13	41	9				
	M.Ed	50	10	50	10				
	TE	40	4	60	6				
	VIII	38	12	53	17	3	1		6
	<b>Average %</b>			<b>49 + 50 = 99</b>		<b>0.3</b>			<b>0.7</b>
11. Size of the book is appropriate/handy	I yr	42	13	33	10	6	2	13	4
	II yr	63	12	32	6			5	1
	III yr	59	10	35	6	6	1		
	IV yr	27	6	18	4	37	8	14	3
	M.Ed	20	4	55	11	20	4	5	1
	TE	40	4	50	5			10	1
	VIII	44	14	31	10	6	2	19	6
	<b>Average %</b>			<b>42 + 36 = 78</b>		<b>11</b>		<b>10</b>	
12. Language used is easy to understand	I yr	61	19	39	12				
	II yr	68	13	32	6				
	III yr	59	10	35	6	6	1		
	IV yr	55	12	45	10				
	M.Ed	20	4	75	15	5	1		
	TE	30	3	60	6	10	1		
	VIII	50	16	38	12	9	3	3	1
	<b>Average %</b>			<b>49 + 46 = 95</b>		<b>4</b>		<b>1</b>	

Moreover, it can be observed from the table 2 that most of the volunteers by agreeing (even strongly) with the statement stated that, flipbook can be used as an instructional material (97 %), it can nurture creativity (96 %), facilitate active learning (96 %), sustain interest in learning (96 %) improve observation skill (91 %), help for individualised instruction (82 %), be a self-learning material (87 %) and can raise students' curiosity (91 %). In support to the study, Jacobs and Ronald (1976) stated that flipbooks can be used for individualised instruction and Monika et al. (2016) found that all the experts opined that

flipbook raises students' curiosity. Further, they also opined that the concepts are completely presented (81 %), colors were suitable (99 %) and language used was easy to understand (95 %). On the other hand, many volunteers emphasised that the thickness of the paper should be reduced (22 %) and size of the book to be increased. But, this size was selected in order to reduce the cost of the book.

In order to motivate the teachers and students to download, print and use for effective and creative teaching-learning

Table 3 QR codes and web links for flipbook templates

Frog Metamorphosis	Nutrition in Amoeba	Locomotion in Hydra	Budding in Hydra	Demonstration video
				
<a href="https://www.docdroid.net/RT7m2Mi/gn-flip-book-to-learn-metamorphosis-in-frog-template.pdf">https://www.docdroid.net/RT7m2Mi/gn-flip-book-to-learn-metamorphosis-in-frog-template.pdf</a>	<a href="https://www.docdroid.net/KUKZVqC/gn-amoeba-nutrition-template-converted.pdf">https://www.docdroid.net/KUKZVqC/gn-amoeba-nutrition-template-converted.pdf</a>	<a href="https://www.docdroid.net/NUpSeyy/gn-hydra-somersaulting-flip-book.pdf">https://www.docdroid.net/NUpSeyy/gn-hydra-somersaulting-flip-book.pdf</a>	<a href="https://www.docdroid.net/YuobdQB/gn-flip-book-to-learn-hydra-budding.pdf">https://www.docdroid.net/YuobdQB/gn-flip-book-to-learn-hydra-budding.pdf</a>	<a href="https://www.youtube.com/watch?v=rmXDI0DxL9c">https://www.youtube.com/watch?v=rmXDI0DxL9c</a>

process, the QR codes and web links of 4 flipbook templates and a demonstration video are given below.

## CONCLUSION

Using clay models of Amoeba and Hydra various biological concepts were depicted. Gradual changes in those processes were photographed, printed, serially arranged and made flipbooks. Experimental group students who learned with flipbook got significantly higher average marks which showed their deeper and better understanding of the concept than control group; which in turn indicated that flipbook can be an effective learning tool. In addition, flipbooks with creative ideas made by the students reflected that flipbook can ignite their creativity. The positive opinion of the teacher educators, trainees and school students reflected that flipbooks can be used as an instructional material, can facilitate active and self-learning. Further, it can raise students' curiosity and sustain interest in learning hence, it is strongly recommended for the school teachers and students for effective and creative learning.

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