Pair Learning Pattern

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This paper introduces "Pair Learning" as an educational pattern to enhance student engagement and comprehension. To confirm students understand a new concept teachers may need to see or hear them complete a challenge, but classes do not have an infinite amount of time so how can they ensure each pupil has a chance to prove their comprehension? Through stories of our own experiences and complementary methodologies, the paper affirms the efficacy of pair learning as a versatile and effective educational strategy across diverse educational settings. These examples underscore how pair learning enhances student interaction and understanding.

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1. INTRODUCTION

This paper introduces a new pattern for teachers to use in their classroom: having students work in pairs. Pair learning is well established in pedagogical literature, but to the authors' knowledge, this is the first time it is being codified as a pattern. An example of existing scholarship is Think-pair-share, a "collaborative teaching strategy first proposed by Frank Lyman of the University of Maryland in 1987" [1]. Its "activities pose a question to students that they must consider alone and then discuss with a neighbor before settling on a final answer. This is a great way to motivate students and promote higher-level thinking" [2]. Another example is from task-based language teaching (TBLT) where "Task-based work and grouping formats, such as group work and pair work, which are a key feature of the approach, give students extensive opportunities to practice and develop their communicative skills." [3]. Pair work is also a featured part of Communicative Language Teaching (CLT) [4] "With CLT began a movement away from traditional lesson formats where the focus was on mastery of different items of grammar and practice through controlled activities such as memorization of dialogs and drills, and toward the use of pair work activities".

Our paper brings this tried and true technique into the pattern world in a friendly way for novice teachers to learn from and experienced ones to reconsider their reliable strategy in a new light. Teachers should be strategic and create innovative ideas. From time to time they have to update the teaching techniques in their classrooms. With pair learning students can demonstrate if they explain to the other students. We have utilized pair learning techniques in our own classrooms. It does not work for all contexts, but in the right situations, it is a time efficient way of giving students opportunities to repeatedly practice what they are learning in the lesson.

2. NEW PATTERN: PAIR LEARNING

In the sub-sections below we mainly use the Context, Problem, Solution format [5] to describe our new Pedagogical and Educational Pattern. We also include "Forces and Constraints" along with "Complementary Approaches" to better contextualize the recommended solution.

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2.1 Name of the Pattern

The name of this pattern is “Pair Learning”.

2.2 Context

- The virtual and in-person class needs to have 4 or more students. For a single instructor, around twenty students is when this pattern is particularly useful.
- This is particularly appropriate for teachers with adult learners and university students. With adjustments it can also work in secondary school, “both lower secondary education (ages 11 to 14) and upper secondary education (ages 14 to 18), i.e., both levels 2 and 3 of the ISCED scale” [6] (ISCED stands for International Standard Classification of Education).
- This can apply in classes for many subjects (e.g., studying English [7], computer science, biology, music) for teachers who want to give students in class a chance to demonstrate learning (e.g., produce spoken English, write a working program, plant an indoor farm, play a song).

2.3 Problem

During class there is only so much time for students to practice what they are learning from their teacher in a lesson. The time they spend listening is important to grasp new concepts. It is also critical to give the students a chance to experiment with them. With many classes having twenty or more students, it is unlikely each participant will have the opportunity to experiment during a lesson.

2.4 Forces and Constraints

- Engaging in individual demonstrations in a large class setting can be challenging due to the sheer number of students that need to present their understanding. This can lead to a lack of time for each student to fully showcase their learning, impacting the depth of feedback and support they receive from their peers and the instructor.
- In a larger class size, the opportunity for personalized attention and targeted interventions may be limited, making it harder for students to receive the individualized support they need to overcome their learning obstacles in challenging subjects.

2.5 Solution

- Have the students break into groups of two to provide opportunities to demonstrate individual initiative by communicating with their peers. In the group of two each participant will have a chance to experiment with the new subject, rather than just listening the entire time. Making the students think more deeply can lead to a deeper understanding of the day’s lesson through teaching,
- Give members of each pair freedom to practice something new in a safe place with a classmate. They may be more willing to try something difficult and risk embarrassment if only in front of one other peer, rather than the entire class. Additionally they will benefit from having to teach and/or explain the concept to their partner. Figuring out how to explain that lesson's concept will help them understand it more fully.
- Give students a reason to want to participate in the pairs. Reasons could include winning rewards and/or gamification such as a point system that tracks their progress over the course of a semester and ranks them on a leaderboard to inspire competition.

2.6 Complementary Approaches

- Utilizing learning in pairs is not meant to be a panacea. It is simply one additional option of many for a talented teacher. It complements other helpful strategies to provide students with the resources to succeed, including small group activities, office hours, hands-on activities, group discussions, visual aids, tutoring sessions, and active learning to help students better understand complex topics.

- Providing opportunities for individualized support and additional practice can also be beneficial in helping students demonstrate comprehension of difficult subjects.
- Complex subjects that are challenging to grasp through traditional lecturing may require alternative teaching methods to cater to diverse learning styles. Incorporating interactive activities, real-world examples, and peer-to-peer discussions can help students better comprehend difficult concepts and enhance their retention of the material.

2.7 Additional Considerations and Benefits

2.7.1 Timing

- It is common for classes to take longer to demonstrate their learning individually as the size of the class increases. This is due to the need for each student to have an opportunity to showcase their understanding, which can be time-consuming with a larger group.
- The larger the size of class the longer it will take for each student to individually demonstrate what they learned to the whole class one at a time. For example, if each student needed two minutes to explain the chapter they read for homework in English class with 24 students, that is 48 minutes of a lesson, with zero time for questions. If they break into twelve pairs and speak for three minutes each to each other, including asking questions, it takes six minutes of a lesson, down from 48 for each to speak individually.

2.7.2 Pair Relations

- The free-rider complex is a naturally occurring phenomenon in behavioral economics and it has a higher chance of occurring when there are more people present in the group work since it is easier for a student to hide in the background. Working as a duo limits the possibility of a group member "riding for free" and contributing a substandard amount of work. Smaller groups put them in the best position to succeed and to truly absorb and engage in the material. Since the free-rider complex occurs subconsciously, the students are not at fault for succumbing to the natural tendency to take a back seat with the assumption that someone out of a larger group will step up to take the reins.
- Some students may not get along with the rest of their classmates. If this is true in your class then putting the wrong two pupils into a pair may be counterproductive.
- Teachers should be mindful of student relations and avoid pairs of people if they know the two of them do not get along. Teachers should also walk through the class to listen into the pairs to ensure the dialogue remains constructive.

2.7.3 Tactics for Organizing Students Into Pairs

- If there are an odd number of students in the class, the teacher can pair with one of them or make a single group of three.
- If the class is done online via video conferencing software, the instructor can utilize "breakout rooms" to put students into pairs.

3. PERSONAL EXPERIENCES

In the following section two authors share their experiences with utilizing pair learning in their classrooms. The author of section 3.1 is Sridevi Ayloo who details pair learning successes in a programming class. In 3.2 Charles Jeffrey Danoff gives examples from teaching a different subject: English as a Foreign Language.

3.1 Teaching Experience in a Computer Programming Class for Students with no Programming Experience

Some of the programming concepts when the theory part is explained students feel like they understand. When the Q&A (Question & Answer) session after the lecture is presented, some students answer well, and some students are not quite sure. When the hands-on assignment for that same topic is assigned to the students in the class. It is more effective if we pair the students for working on the assignment. There are different ways of making pairs. We have to observe the students, their competency in using the English language, their native language, English language learners and students who were answering questions in the Q&A session. Teachers

must intervene and guide the discussions in the class and when the students are working in groups, to yield better results.

In my experience the students did well when they were matched with the right partner. It was effective and there was active learning. Inclusiveness should be there, then the student feels belonged and cared for in the class. Then the student performs better in class. The students learn faster from their peers than the teacher. Students feel comfortable approaching their peers. Each student when paired with the other student starts to understand they can depend on the other student in the group. In a group consisting of two students, one student can be better at comprehending the material and the other student can be better at programming, critical thinking and so on.

Students were participating in the class and felt accomplished and this built confidence in them. They would look forward to attending the class and learning more. The class will be student-centered instruction rather than teacher-centered instruction. For programming class student content mastery is a very useful tool to be successful. There can be beginning learners, developing learners, proficient learners and distinguished learners. Project based learning works well for computer programming classes.

For each assignment based on the student performances the pairs were matched with different students. Students will learn to communicate with other students too. Learning outcomes depend on the class size. As a teacher we have to constantly motivate the class and create an active learning environment. Students can perform better and to some extent it depends on the teaching styles.

3.2 Teaching Experience in an English Class

While I was teaching junior high school English in China I had classes with between twenty to forty students. Given lessons were roughly an hour in length, there were not many opportunities for them to speak English individually. Accordingly, I had them work in pairs to do tasks such as read a comic strip in English [8] and discuss what was happening on the page. There were also speaking activities where they were assigned to speak in pairs. It worked, but there were challenges as I noted [9] “still I have to walk around and work with most pairs individually before any progress can be made. Might be better to try letting them make the pairs themselves.”

When students did choose their own partner, most of the time students were able to work well together. However, I found that putting the students into pairs on their own sometimes also led to unproductive outcomes. At times they just chose friends and goofed off, but I think this is an acceptable risk for the benefits of pair learning. Whether choosing pairs for students or letting them decide on their own, to navigate these situations, it was very important how well I grasped the English level of the individual students relative to the difficulty of a given task. If the task was too hard or too easy, it impacted the success of the pair learning approach.

4. DISCUSSION

The benefits of learning in pairs are not only seen in pedagogical environments. They also extend to peeragogical ones, as detailed in the case study from the Peeragogy Handbook [10] “We call them Students With Abilities in Technology (SWATs). In case of difficulty, SWATs can be called in, and can decide if they want to give advice to peers and the teacher in the use of Scratch”. Scratch is a software program developed by the Massachusetts Institute of Technology for learning programming. After those interactions, “We see how, as the use of technology in all learning environments becomes general, this approach of peer learning becomes an alternative to underpin the work of teachers. The figure of the SWAT in the classroom also enables a different form of relationship between pairs that generate new forms of interaction and learning that we can appraise and evaluate.”

There are also benefits from learning in pairs outside the classroom. The next two sections are also written by teachers, but who share experiences that show the versatility of learning in pairs as an approach. In 4.1 Mary Tedeschi writes about pair programming and in 4.2 Isaih Battiste details how workshop attendees successfully completed pair work.

4.1 Pair Programming

Pair programming fosters a collaborative environment where continuous learning and code quality are prioritized, aligning well with the goals of Extreme Programming. I was familiar with C and Unix, but we worked in a large organization with a highly diverse environment. As a server side C++ and Java programmer, I worked

with a client side Visual Basic programmer and I also collaborated with mainframe COBOL and assembler programmers. I was tasked with porting COBOL copybooks to Java header files. My time at New York Life Insurance enabled me to put XP into practice and my experience with pair programming was positive.

- Improved Code Quality: Continuous code review by the navigator often leads to fewer defects and better code quality.
- Knowledge Sharing: Developers share knowledge, ensuring that skills and information are spread throughout the team.
- Enhanced Collaboration: Encourages teamwork and communication, leading to more cohesive team dynamics.
- Faster Problem Solving: Two minds can often solve problems faster and more effectively than one.
- Increased Learning: Developers can learn new techniques and approaches from each other in real time.

I was a doctoral student given the Kent Beck Extreme Programming book [11]. After reading it, I actually was able to use it at work. I worked at New York Life Insurance, which utilized both mainframes and client-server systems, where we successfully implemented pair programming. I was able to interface with the client (Visual Basic), I was on the server using C/C++, then Java. I worked with CISC, Assembler, COBOL. Collaboration was the key to doing all of the work within tight deadlines. Having just read Kent Beck's book [11] was helpful in changing my thinking. Managers would have had us each work alone instead of in pairs. Our productivity was measured by LOC or lines of code. You can write more LOC in pairs than alone.

Additionally, the strength of the pair came from each of us being well-versed in our respective computer languages, hardware, installation processes, and system architecture, which was crucial in eliminating bugs in our software. I worked with AIX on RS6000 machines, as well as SunOS and Sun Solaris, and had a solid understanding of the differences between their shell programming environments.

4.2 Workshop Pair Learning

After graduating from college I wanted to stay involved with my fraternity and chose to take a position in leading and developing educational programming for both alumni and undergraduate brothers. Even though we shared the same fraternal bond, it was still nerve-wracking to speak publicly to an auditorium full of students and some older alumni about topics that they might not know much about or have much initial interest in. From my experience in being in the same seats that they were once in, as well as being in front of them to speak, I found that the least-productive workshops were ones that lacked any sort of hands-on activities. The students dealt with enough lectures Monday through Friday through their professors, and as a professor myself I knew better than to add to their plate on a Saturday morning, especially in the fall.

In order to combat this, I introduced think-pair-share [1,2] concepts to the workshops. In some cases, we did not have time for 25 pairs of brothers to share their thoughts after being given a prompt, but we did find that the liveliest discussions were had when brothers were split into groups either by chapter, or randomly in groups of about five.

The idea of competitive spirit amongst chapters, with each wanting to have the most creative and thought-provoking solutions to problems posed is what typically led the charge and energized discussions. However, what I found most rewarding while in either position, educator or participant, was when we grouped individuals on a random basis. This typically led to barriers being brought down, and ice being broken, per se. The groupings that consisted of brothers each from different chapters or age groups (undergraduate, graduate, young alumni, and older alumni perspectives) usually had the most interesting responses that breathed life into discussions, with ideas that seemed fresh, passionate, and creative.

Instead of competition being the motivating factor amongst rival chapters with storied histories, the number one driver genuinely became finding solutions to problems. With each group being diverse, they motivated every brother to have their say within a smaller group setting, without fear of their ideas getting shot down when first

being introduced against an auditorium. I found that brothers got to know each other this way, bonds were formed, and respect was shown more often to "thinking outside of the b
ox" ideas when they were brought up in a face-to-face way, much like how sitting down to have a coffee together can loosen people up for fresh ideas and ways of thinking as well.

5. CONCLUSION

The pair learning pattern is an effective strategy to give students an opportunity to demonstrate understanding of a new concept while learning English, software programming, and other topics. The benefits of utilizing the pattern do include navigating time constraints and free-rider issues in a single lesson, but the primary benefits are the learning effects produced by the approach. To amplify the teacher's instruction, students can learn by teaching one of their peers and then being taught by one.

6. CONNECTIONS TO OTHER PATTERNS

- Pair Programming
- Patterns of Peeragogy
- Teach English with Comics
- Active Learning Patterns for Teachers from Iba Lab
- Pedagogical Patterns
- Educational Patterns

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