

HAVE YOU FELT BLUE OR RED? A COLOUR-BASED TOOL FOR CULTURALLY PLURAL TEAMS

Author ONE¹, Author TWO²

¹Author one and two affiliation

ABSTRACT

The extensive practice of collaborative design-based learning and the increasing cultural plurality of design courses in Design Education is becoming relevant. Students' critical reflection on teamwork experience through structured activities of self-, peer and group evaluation can provide a space for students to ask themselves relevant questions and to discuss together with the team about each one's reflections. A guided sharing of personal perspectives on teamwork reveals to students the existence of multiple viewpoints and perceptions and supports an increasing mutual understanding and sensitivity. To this extent a colour-based assessment tool for teams, the Teamwork Colour Matrix (TCM), was designed with the idea that colours can take on very different associations for each individual and therefore can leave more freedom of expression, especially when it comes to evaluating teamwork. Students intuitively coded their experience in relation to the different moments of teamwork and represented it inside of the TCM by using eight given colours. The paper presents the qualitative data collected during the redesign and remote application of the TCM, showing how it can both support students to reflect and evaluate plural remote teamwork, and teachers to monitor team dynamics within collaborative design-based learning courses. The test also provided rich data about the challenges that students experienced in the current collaborative distance learning context, which could contribute to acknowledge learning trajectories of students in this type of courses.

Keywords: culturally plural teams, design-based learning, visual communication, peer evaluation, self-evaluation

1 INTRODUCTION

The collaborative design-based learning approach is widely adopted to teach design in higher education institutions; according to it students learn design by doing it collaboratively with other peers. These collaborative learning-by-doing practices are continuously evolving according to the socio-cultural changes around and within the educational context where they happen. In this regard, our interest specifically concerns the increasing cultural plurality of classes that have been determined by several contemporary factors such as the growing global mobility, the centrality of internalisation strategies in higher education and the emergence of interdisciplinary curricula just to mention a few. These generalised phenomena are particularly significant in design education when students learn how to design through group projects, because collaborative learning becomes the stage where they can also improve their soft skills. Specifically global competences, as described by the EU commission, are all the ability to relate with culturally plural others being sensitive towards individual differences. [1] In the last years, the authors focused on the effective teaching strategies that can support the development of these skills in plural design education contexts. A particular attention was dedicated to self-, peer and group assessment [2] by designing structured moments and activities to promote students reflective practice on soft-skills [3]. The researchers glimpsed the possibility of conveying the students' reflection by using a shared language among all designers: the visual language, which is the basis of design discipline. The use of the principles of visual communication is proposed, mainly through colour and shape, to activate the dialog inside the team. The potentialities of visual language to communicate between cultures, generations, or plural groups of people, is related to human ability to deduct information and to associate feelings and emotions to images or visual elements [4].

Through action research iterations in the Master of Science in Design and Engineering at XXX (Institution) we developed a visual communication tool, the Teamwork Color Matrix (TCM) [5] to

support assessment and reflection on teamwork in plural teams where students represents the process of teamwork through an abstract colour composition. The preliminary test of the TCM in presence was very positive, since the visual communication strategy turned out to be an effective and more culture-sensitive way to evaluate a process and people participating in it [5]. Before further testing of the analog TCM version, design education faced another radical shift during the last year toward distance learning, due to the pandemic emergency. This situation affected the in-class interactions among students and teachers and the student-to-student interaction within the team. Thus the distance added a further level of complexity for teams, possibly aggravated by the stress conditions experienced by learners related to the pandemic and to work from different time zones. Besides, teachers didn't have in-class moments to observe students, adding a further obstacle for the monitoring of team dynamics. For all these reasons, it became urgent to provide a virtual tool for students to evaluate teamwork and for teachers to monitor teamwork. By adopting an action research approach, the TCM tool was redesigned for distant learning and tested within a dedicated path on teamwork within the above named Master program. The paper presents the qualitative data collected during the tool testing, showing how it can both support students to reflect and evaluate plural remote teamwork, and teachers to monitor team dynamics within collaborative design-based learning courses. Eventually the test provided rich data about the recurring difficulties that students experienced in this particular education context, which could contribute to acknowledge the students' challenges in culturally-plural teams and also those introduced by distant collaborative learning in traditional design-based learning courses.

2 METHOD

2.1 Teamwork Colour Matrix: tool, sample and remote application

The TCM consists of a blank orthogonal grid designed to be the canvas that each student will fill with one or more colours, taken from a predefined 8-colours palette. Within the TCM, students can divide the teamwork experience into the different moments lived and perceived, and associate the colors spontaneously to visually represent each part of the process. First, students are required to evaluate the collective experience of teamwork (fig. 1, team evaluation) by making a colour composition in the upper part of the grid. After this, they are asked to produce a brief written description of the visual representation. Secondly, students assess the individual performances -the self and peers- of each team member (fig. 1, individual evaluation), in the lower part of the TCM. Again, they are asked to write detailed notes about the chromatic composition. The grid is divided in rectangles to provide students an easy path for representation as the parts can be interpreted as single moments, or summed portions, or time percentages during the collective experience of teamwork (fig. 1, teamwork timeline). The diversity of the chromatic palette is intended to motivate the students to visually represent different moods, moments or meanings when communicating the teamwork experience [6]. In other words, the 8 selected hues are conducive to be linked to positive-negative, intense-dull, active-passive and/or simple-complex associations, among others. At the end of the activity, both group and individual evaluations are expressed inside the TCM as visual communication, in the shape of an intuitive colour composition.

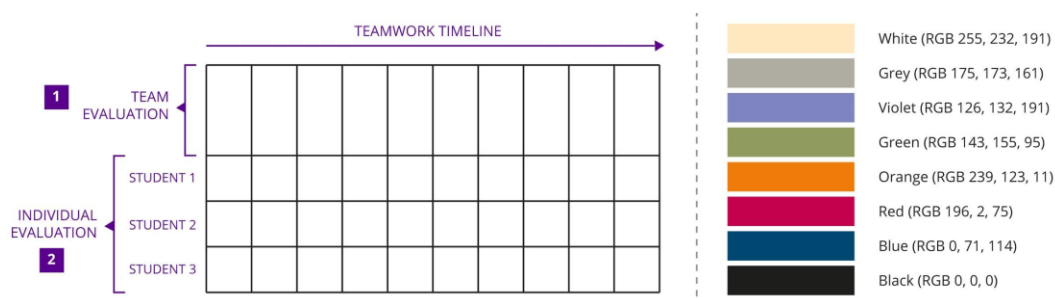


Figure 1. Teamwork Colour Matrix and the colour palette selected

The analogue version of the TCM was tested with 15 international students, during 2019, after the design studio of an interdisciplinary one-year master course in Industrial Design. On that occasion the TCM was physically applied, in the classroom, with cardboard and colored paper. The main results showed that all students were able to evaluate teamwork by using visual communication through colours, and that students relied very much on their TCMs to tell others their own experience within the team. An in-depth analysis to the first testing, the explanation of how the grid was designed, how the colour palette was selected and the test results, can be found in a previous paper published by the authors [5]. Due to

the COVID-19 contingency, the TCM was adapted to a digital format to continue providing teamwork assessment support to students, although teamwork was conducted remotely. The online version of the tool was applied to 123 students of the MSc in Design & Engineering of XXX (Institution). For the aim of this paper, the sample analysed consists of 32 students of the Product Development Design Studio I, that came from very different origins (mainly Europe, Asia and Latin America) and different backgrounds (Design, Engineering, Robotics, Arts, Multimedia, Materials Science, among others). The course was divided into 9 cross-cultural teams of 3-4 people. The teams were decided by the students, after a brief individual presentation, and they were required to mix different origins and backgrounds inside the team. The teams worked together for four months and were supervised by three teachers, which are not part of the research team of this study.

Within the course, a specific path was dedicated to teamwork called “Seminar on Teamwork” and led by the researchers as facilitators outside the teaching staff. As in the local education system there is a strong hierarchy between teachers and learners, teachers decided not to directly interfere with teams’ dynamics nor push students with different sensitivity to open up in front of the professors. Therefore, the activities proposed during the Seminar were presented by the researchers, outside of class time, and were done autonomously by students. The seminar included three main activities for teambuilding and teamwork, namely 1) icebreaker and team formation, 2) team agreement and 3) self-, peer and group assessment after the first delivery. The TCM was done as part of the latter activity. As mentioned before, the TCM was adapted to a PowerPoint presentation that consisted mainly of 2 slides or cards: the first, presents the TCM blank grid and the colour palette available to the students. On this card, students can perform the group, self and peer evaluations, as indicated above, and provide the identification data for themselves, and for each of the teammates. The second card is divided into 2 text fields: the upper part is for the written description of the teamwork evaluation, and the lower part, for the description of each team member's performance, self- and peer assessment. The activity started with a brief video explanation by the researchers about the matrix, the materials and the goal of the exercise, to then proceed to individual work in both cards of the digital TCM. After the cards were completed, students were asked to gather in the teams, by using a classroom software, to explain and discuss their results of the realisation of the TCM, as a starting point to motivate conversation supported by visual communication. This activity produced a shared understanding of the collective experience of working together. After the team discussion, students sent back their TCM cards to the researchers for data analysis.

2.2 Analysis strategy for the data obtained

As the researchers didn't know the participant students previously, the qualitative interpretation of data was based on visual communication and then verified with the written descriptions in the TCMs, without any additional information. The analysis focused mainly on three lines of study: a) to further validate visual communication as an effective strategy for plural students to share their feelings about the teamwork experience; b) to map recurring challenges that students experience in culturally-plural remote teams; and c) to provide guidelines for reading the visual elements inside the TCMs enhancing teachers’ monitoring of teamwork in a soft way, this is, with an inclusive and respectful attitude towards students’ issues regarding directly reporting about themselves and peers to professors. To this extent, the researchers performed a visual analysis to group representation in the TCMs by focusing on the appearance of alignments/misalignments, colour uniformity/changes and the division of the TCMs into colour phases or moments inside the teamwork process. Then, the same visual elements were analysed regarding the individual performances, by tracking colour analogies and differences between the author’s self colour representation and the teammates’ representation, and also between each person’s performance and the teamwork representation. A cross-analysis between the group TCMs was then performed to understand the situations that emerged from a more complete point of view. The visual analysis led to an interpretation of the process of teamwork, which was finally validated by reading the students descriptions of their TCM.

3 RESULTS

3.1 Team 3: an example of data analysis and results

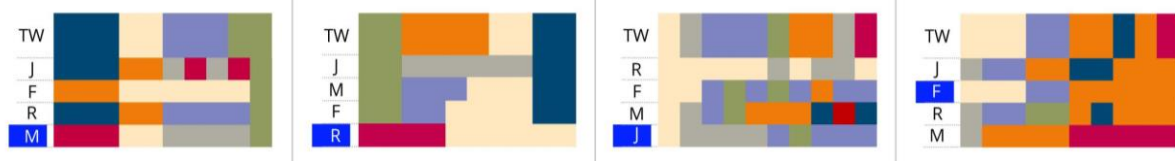


Figure 2. Example: TCMs of team 3, respectively made by students M, R, J and F.

Before proceeding with an account of the results obtained, an example of the analysis done is presented. In fig. 2 the TCMs created by the four team members (called here as M, R, J and F) are displayed, while in table 1 the qualitative observations noted by the researchers are reported together with the interpretation developed by cross-analysing the TCMs of the entire team. The final row of the table is dedicated to a short summary of the descriptions written by students, used to corroborate the interpretation. It's possible to notice that the interpretation matches the inner team dynamics even if without details about the specific facts.

Table 1. Example: TCMs made by team 3, respectively made by students M, R, J and F.

Team 3	TCMs Analysis	Notes based on visual communication
TCM student M		<ul style="list-style-type: none"> a) All teammates are aligned at the end of teamwork (green) b) J and R are represented as very much aligned. F and M are not aligned with them. c) There's something going on at the middle/end phase with J (sudden colour change, increased intensity of colour red) d) M represents herself in a very different way (red) compared to the rest of the TCM.
TCM student R		<ul style="list-style-type: none"> a) All teammates are never completely aligned. b) All teammates are aligned in a 40% of the TCM, except for R, who does not match this alignment. c) F and M are very much aligned (90%). d) R represents himself in a very different way (red colour) regarding other students and teamwork in the initial and final phases.
TCM student J		<ul style="list-style-type: none"> a) All teammates are aligned in the initial part (beige colour), but there is misalignment in the second half (lack of coincidence). b) Something happened with M in the middle/final phase, she has been represented with very different intense colours.
TCM student F		<ul style="list-style-type: none"> a) J and R are very much aligned (70%). b) Something happened to M in the middle/final phase, she has been represented with a very intense colour (red). c) M and F are not aligned between each other at all (0%). d) All teammates are never completely aligned.

Researchers interpretation of Team 3 based on the visual representations

It is observed that students identify different moments or phases of teamwork (very clear M's and R's TCMs). The teamwork isn't much aligned with team members, despite the color selection seeming similar in the teamwork and team member parts of the TCMs. J and R are perceived as aligned by M and F, even if J and R don't represent themselves as aligned. The same happens with M and F in the perception of R. Apparently something happened with student M at some point in the middle, represented by all team members except for R. The final moments of teamwork present a greater alignment among team members.

Summary of students' descriptions

All team members describe teamwork very positively, except for J who acknowledges the existence of

a conflict at the middle/end phase. At the beginning team members didn't know each other and everybody describes the initial moment as a misaligned one; especially F who initially was in her hometown and describes distance as an obstacle for teamwork. The final phase was stressful but all the team was focused on the delivery. From J's perspective a division in the team exists: the two girls designers (M and F) on one side, and the two boys engineers (R and J) on the other. Both M and J reported moments of discussion in the middle/final part of teamwork. Student J mentions that the "design couple" excluded the "engineers" because they were not skilled enough in using a specific design software. In his words, there was an explicit call for peer learning addressed to the designers, also for R who mentions the talent of the two designers and his desire to learn from them. The others' storytelling supports the idea that the two boys were very cohesive with each other, and the girls, despite some differences, were very much connected, aligned and balanced.

3.2 Results account

The results obtained from the visual analysis that could provide some guidelines for reading the TCMs refer mainly to the appearance of analogies and differences among the chromatic representations. In group and individual performances, most students use the resources of colour similarity and changes to visually mark the duration, the beginning and end of the different moments or phases perceived in the teamwork process. This constancy or inconstancy in the application of colour, visually informs the teacher about possible situations or conflicts in the group dynamics, which is reinforced when some coincidences can be seen between the compositions of students belonging to the same group. Some of the most important visual elements to notice are:

- Alignments, similarities and/or coincidences: within one specific TCM or even in the comparison between the TCMs of the group members, colour alignments are a useful visual element to observe the students' perception of how the team worked. As the different individual performances can be compared with the group performance inside of a TCM, it is possible to observe which students were (or not) aligned with the teamwork (e.g. the alignments between a part of the students of the group or, misalignments of one student with the rest of the group). It is also interesting to note if there were some moments in which the entire group was aligned with each other (or not), and at what stage of the teamwork process these coincidences occur. For instance, in most of the cases, teammates divided the process of teamwork in a matching amount of colours (3-4 moments or phases within the teamwork).
- Colour differences, sudden changes and contrast: when noticeable differences or suddenly it appears a great contrast in the application of colour for the representation of teamwork or individual performances, it is usually an indicator of a special situation or issue, a conflict between teammates, a moment of high stress (e.g. a delivery date) or a very different individual attitude from that of the rest of the group.
- High colour intensity vs. achromaticity: although the students do not receive any reference on colour psychology prior to the completion of the TCM, the results show a great variety of semantic colour associations. Without going into the specificity of colour language, it is possible to notice the appearance of colour saturation -intense or vivid colors- to indicate intense positive or negative moments during teamwork (e.g. stressful events, discussion between teammates, a very productive phase or high enthusiasm about work). On the other hand, achromatic colours (grey and black) are usually used by students to represent a passive attitude to work, flat moments within the teamwork, confusion, poor motivation or little understanding between the team members.

Another important result is that all the students involved in the test communicated as much visually as in words, providing a quite accurate overview on their teamwork experiences. Regarding the tool, it's worth saying that the cross-analysis of the TCMs provided a fairly accurate reading of each team and individual student contribution; this supports the idea that abstract visual communication could effectively enhance self-, peers and group assessment activities. The descriptions provided by each student were essential to understand specific situations, behaviours or conditions that influenced teamwork dynamics. Another relevant result is that a clear plural attitude toward assessment emerged since not all the students demonstrate the same confidence in making explicit reference to the critical points of collaboration, such as conflicts and disagreements (e.g. J was the only one reporting a division in team 3). Still respecting individual and cultural differences in dealing with conflicts, the TCM visual representation prompted each student to communicate alignments and misalignments with others and with the overall process of teamwork. This description is highly detailed in regard to time and interrelations in the team, but generic on the specific facts or behaviours due to its abstraction.

From students storytelling some recurring elements emerged. The majority of students described the process of teamwork by dividing the grid space into phases and by reporting them in their descriptions. As external observers, the identification of these phases was the first step to analyse the TCMs. The main result is that all the teams experienced an initial phase dedicated to knowing the others in the team, a middle phase where students report moments of misalignment due to various reasons (e.g. misunderstandings, bad communication, different approaches to teamwork, decisions to take, lack of skills, bad revisions with professors) and a very intense final phase before the delivery. It also emerges that within the course, which is highly design oriented, often the designers in the teams tend to push aside engineers, who do not already have some design-related skills. In several cases (e.g. team 3), engineers make explicit calls for peer learning towards their design colleagues. Finally, students' descriptions clearly highlight that, in this blended teamwork (i.e. some students at the University and some in their hometowns), those who worked from distance had troubles in effectively contributing to teamwork and were sometimes excluded by the other team members.

4 DISCUSSION

The results show that all the students were able to assess the self, peers and group using visual communication, which guaranteed a degree of freedom in the approach to the evaluation itself. Students' individual abstract representation of the teamwork experience was fundamental for an external observer to gain an overall understanding of the process and contributions of each student. The method developed and described to interpret the TCMs was validated and demonstrated to be accurate and possibly replicable by other researchers or teachers. Indeed for 8 teams out of 9 the interpretation based on the visual elements was coherent with the descriptions provided by students, similarly to what happens with team 3. Some relevant themes and challenges arise from students' visual compositions and storytelling and are here briefly addressed. Firstly, the process of teamwork is often visually divided into phases which usually correspond to an initial phase of ice breaking, lack of mutual understanding or knowledge; then a middle phase where the team faces issues or challenges; and a final intense phase before the deadline for the delivery, which appears to be often stressful and related to arguing. In two teams these arguments took place in an early phase which led the teams to a deeper discussion and collective agreement on the collaboration rules; in these groups the final phase appeared to be less stressful and conflictual. Another recurring topic is the tasks division that occurs within teams, which is often led by designers intended as the "experts" of the design process and sometimes resulting in the exclusion of engineers from several tasks related to concept development, visual research and project display. This phenomenon was also detected in cases where students, regardless of their background, demonstrate a lack of hard skills in some domains. Future research should envision ways to develop teaching activities to structure the peer learning within teams, possibly reducing the exclusion of low skilled students and enhancing the learning experience for all. The last topic that is worth mentioning is the difficulties experienced by students working from a distance, who turned out to be often excluded or somehow disadvantaged in participating in team activities. Also due to the historical moment we are facing, it's crucial now to address this reality by structuring teaching and learning activity that can effectively promote the inclusion of distant students in blended learning. For all these reasons the TCM test was very positive and also, as a teaching activity, it supported the understanding of the new learning realities encountered by students, which in our view should be expanded and addressed by institutions and teachers. In this regard the TCM constitutes a first step to raise awareness on the importance of teamwork as a learning experience in design-based courses and could hopefully be used by students to reflect on their learning as much as by teachers to monitor and support teams they supervise.

REFERENCES

- [1] European Commission. Key competences for lifelong learning, 2007, pp. 1-103, Brussels.
- [2] Author 1, 2019
- [3] Sluijsmans, D., Dochy, F., & Moerkerke, G. Creating a learning environment by using self-, peer-and co-assessment. *Learning Environments Research*, 1(3), 1999, 293–319.
- [4] Dondis, D. A. *La sintaxis de la imagen*. Barcelona: Gustavo Gili, 1976.
- [5] Author 2 and 1, 2020
- [6] Jonauskaitė, D., Althaus, B., Dael, N., Dan-Glauser, E. and Mohr C. What color do you feel? Color choices are driven by mood. *Color Research & Application*, 44 (2), 2019, pp. 272-284