After thinking I would love to have our session followed by these protocols:

Protocol 1: NAO teaches one kid one session for one of the instruments, having social communication with one kid in sessions. (much safer, and had experience before with such dyadic communications), need therapist approved language context for sessions.

Protocol 2: NAO teaches **multiple autistic kids (two or more)** one session for one of the instruments, lead kids for social communications e.g. turn taking (little bit risky, but would be a good practice for social skills), need therapist approved language social context for sessions. NAO plays the role of a therapist or a social bridge for kids.

Protocol 3: NAO teaches **multiple kids (TD & ASD)** one session for one of the instruments (huge risk, but outcome may also have great impact), same activities as Protocol 2, but need more carefully designed sessions.

Regarding protocols, problems need to be solved:

1. Music instrument need to be finalized, e.g. xylophone, drum, launchpad.
2. Type of music need to be finalized, e.g. different levels of individual songs, one difficult song but cutted into different pieces, notes combination practice, Patapon type music game.
3. Different phases need to be defined, regarding the reference I have read, different type of music activities have been implemented for music therapy, some of the top techniques for music therapy applied are: singing and vocalization, instrument play, movement and dance, music improvisation (free and thematic). Computer-Based music activities also has been applied in music therapy less than 50% of the time. Behavioral approach to music therapy.
4. Different skills have been targeted during music therapy session. Communication, social and emotional skills are top three skills which have been trained with ASDs, music skills is one of the less care skills among all skills. That makes me thinking maybe for quantitative measurement, music skills may not be a good idea, since people have different talent on music, that could be crucial for some kids not just ASDs but also TDs.

Session design (using a whole song):

Protocol 1:

1. Before session starts:
   1. Interview subjects individually, need informations from each of them to design customized intervention sessions. Song chosen by subject.
   2. A standard music training will be provided as well, this song chosen by clinics which should be familiar to all subjects such as Jingle bell.
   3. It would be good to have ADOS and WISC from subjects.
   4. Make sure that subjects are not sound sensitive.

2. First phase:

1. A general song will be played to subject, ask the kid to sing along with the robot.
2. The general song will be decomposed to different parts for different instrument to be able to play with, simply divided into two parts, melody and rhythm. Subjects will be asked to learn both of them. The order of this learn phase with their choice, they can either of part to learn first and once aced one part, the second part will be taught after.
3. While learning one of the parts of the song, subject will be taught note by note/ beat by beat, one session will learn at least one sentence of the song how to play it, for maximum 3 times to finish first instrument.
4. Do the same process to finish up the second part of the song, and play along with the robot the entire song.

3. Second phase:

1. A chosen song will be played by robot, ask the subject to sing along or mimic along with the robot.
2. Repeat first phase part b to d.

Protocol 2:

1. Same activities will be delivered by the robot, however in this phase, only general song will be played.
2. We will select the subjects from protocol 1, and pair them with the score they have from different instrument, one subject play beats and the other play rhythm.
3. Robot will become a adviser which can help them work with each other and play the whole song. This will happen at most 2 sessions, depends on how the participants feels like.
4. They can also call off the session immediately if they don’t want to play with their partner.

Protocol 3:

1. Still need to think more about this one, should we do it or not.
2. Maybe we can use one ASD participant and one adult clinic for a post assessment, that will require them to do the same thing at the beginning of the sessions and provide details regarding their social skills improvement or not.
3. If we are going to use TD kids for this session, then we need strong support from clinics during the session. They have to be there and observe the entire session in case anything happens.

Measurement:

1. Social skills:
   1. During the session, robot will keep delivering vocal prompt to subjects, let them know when and how to play, if the subject plays randomly, the robot have to capability to stop them and deliver the proper behavior commands. Meaningful play (sequence of notes or beats will be considered as meaningful play, random play cannot be considered as meaningful play even sometimes hit the right note or beat) after robot command will be counted for post data analysis.
   2. During the session, subjects’ turn taking skills will be practiced, they will learn the order of how to play music as a team, and can implement this skill during social contant.
   3. Eye-gaze/ joint attention skills will also be trained during the sessions, the kids need to watch how the robot does the movement and then make sure they focus on the task not looking around. They should be able to learn and follow robot’s commands with their gaze and attention. The measurement will be same as previous study.

2. Verbal communication skills:

1. During sessions, robot will keep delivering vocal prompt to subjects, and encourage them to provide vocal feedback to the robot, once the subject provides proper answer, robot will play a reward short music to the subject.
2. Robot will also encourage subjects to ask questions whenever they need help.

3. Emotional skills (optional task):

1. Q-sensor can still be involved in this part, subjects will be asked to wear a Q-sensor with them during sessions. Since Q-sensor has a real time monitoring feature, we may able to check the EDA changes in real-time (although, we tested this feature, it didn’t work very well, always lost connection, but still worth a try).
2. Post process EDA data, sync with videos and see how the emotion changes during sessions using the method we have applied to our previous study.

Session design (music (video) game based):

Protocol 1: